Development of the „Food Quality Control Lab“ and the „Food Production Systems Management Lab / ICT-center“ within the project „MSc in Sustainable Food Production Systems / STEPS“

justification for equipment specification modification
detailed argumentation and specification for equipment procurement

(Erasmus+, Key Action - 2 Cooperation for innovation and the exchange of good practices - Capacity Building in the field of higher education)

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CONTENT

1. Justification for equipment specification modification within the Erasmus+ project„**MSc in Sustainable Food Production Systems / STEPS**“

During the application of the project proposal „MSc in Sustainable Food Production Systems / STEPS“ within the Erasmus+ Key Action - 2 Cooperation for innovation and the exchange of good practices - Capacity Building in the field of higher education, Biotechnical Faculty of the University of Bihać has proposed the procurement of the Universal smoking chamber (UKM compact) along with the other indicated equipment items. As it was determined in the aftermath, Biotechnical Faculty of the University of Bihać has no required technical conditions for the placement and instalation of semi-industrial equipment which in addition requires construction works, technical and material modifications thus demanding an exstensive financial investment. Furthermore, the maintanace of this equipment piece demands additional funds, as well. Considering all the mentioned reasons, University of Bihać had decided to replace the Universal smoking chamber (UKM compact) with the following equipment items:

Item: Food quality control experimental devices

- Kjeldahl Distillation Solutions for Food and Feed - Automatic distillation unit,
- Analytical Instrument - Automated Titrators,
- Laboratory mill - Instrument for grinding and homogenizing foods and feeds,
- Moisture Analyze and,
- VORTEX - laboratory orbital shaker

The funds anticipated fot the procurement of the Universal smoking chamber (UKM compact), should be directed for the procurement of the item „Food quality control experimental devices“.

The utilization of these equipment pieces for the purpose of development of the „Food Quality Control Lab“ and the „Food Production Systems Management Lab / ICT-center“ within the STEPS project is detailed described in the following pages of this document.

Besides, University of Bihać claims no other changes in regards to the original equipment specification list. The item „Desktop computers, network devices/tools, educational software is more detailed elaborated in this modified specification list. (The exact number and detailed specification of computers, servers, network devices/tools and software is shown).

2. Arguments for purchasing equipment for the project:

2.1. Description

The aim is to build the capacity of laboratories of partner countries in terms of:

ICT-centres equipped with computers, software and relevant infrastructures that will be used for the development/enhancement of teaching/learning environment.

Advanced measurement instrumentation related to small-scale food processing and most importantly, food quality and control.

Licenses of advanced software tools used for analysing processes and supply chain scenarios, in terms of supply chain management, energy consumption and environmental impact, and the evaluation of feasibility of basic and alternative scenarios.

Two types of laboratories will be developed:

The first will be the “Food Quality Control Lab”; it will offer the advantage of specifying experimentally the quality of agricultural products.

The second will be the “Food Production Systems Management Lab”; it will offer an opportunity for the students to design and analyse processes and supply chains and to evaluate the performance of production systems, in terms of energy consumption, and environmental impact.

The equipment will be used to improve the quality of teaching and the level of knowledge delivered, but it will also increase the potential of the scientific staff so that they are able to prepare and publish research articles in international scientific journals and conferences. These types of laboratories in the partner countries will offer also the opportunity to organise joint programmes with industrial partners or small and medium private sector companies, and national bodies involved in decision-making and the development of policies.

Considering the educational content of the STEPS programme in particular, each of the experiments and simulations and training material should include learning outcomes on an experiment/simulation level, a detailed description of the experiment/simulation, guidance and a description of the steps towards the successful implementation of the activity.

2.2. Development of teaching/learning environment

ICT centres will be developed in all partner countries, in order to develop and enhance the teaching/learning environment and the infrastructures in terms of computer, network devices and related infrastructures as well as educational software tools that will support the quality of teaching practices.

2.3. Development of research labs

After the installation of equipment, small-scale demonstrations will be provided , so that the scientific and technical staff can become familiar with the operation of the devices and prepare experiments/simulations and develop the training material of the planned activities.

2.4. Development of experiments/ simulations and training material

Scientific staff will design laboratory and software-based exercises and projects, with the aim of exploiting the purchased facilities to the maximum degree and further improving the level of knowledge.

For each of the experiments and simulations, training material will be developed by scientific staff. Training material will be based on learning outcomes of the experiment/simulation level and will include a detailed description of the experiment/simulation, guidance and a description of the steps towards the successful implementation of the activity, samples as well as samples of the results and scenarios for additional exercises and research.

The progress of the tasks will be monitored based on indicators which will include, among others, the number of facilities/software licenses purchased and installed, the number of laboratory experiments and software simulations designed, the amount of training and the number of manuals developed. Scientific staff will be asked about the level of satisfaction regarding the equipment installed, the number and the level at which the equipment supports the courses.

3. Development of the „**Food Quality Control Lab**“

3.1. Project activity

To procure a specific instrumental laboratory equipment to be addition to already existing instrumental laboratory equipment at the Biotechnical Faculty of the University of Bihać. It would be used for the development and establishment of the “Food Quality Control Lab” for education purposes of Master students.

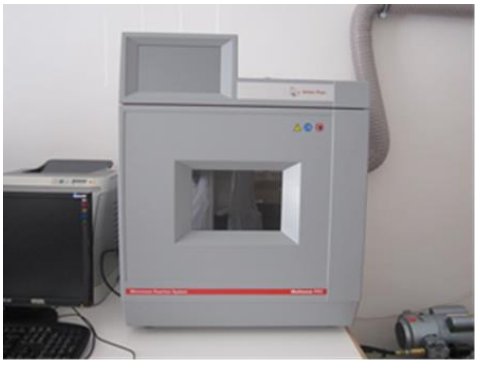
3.2. The existing laboratory conditions at the Biotechnical Faculty

The Laboratory of the Biotechnical Faculty of the University of Bihac possesses a large number of instruments for qualitative and quantitative analysis and acquisition of knowledge in the field of Food Technology, Food Analysis, Quality Control of Food and Beverages. Located in a separate building in the area of approx. 410 m2. There are five laboratories for performing the experimental part of the lesson, two external service laboratories and one laboratory for scientific research. Laboratory work is based on the core disciplines that are envisaged in the curriculum. The aim of the laboratory work or the experimental part of the course is to enable the students to work independently in accordance with the rules of the profession and on the basis of the latest scientific and professional knowledge. In this way, a cadre will be formed who will have the necessary knowledge and who will be enabled to apply scientific knowledge and practical experience.

The work of laboratories in all their segments is comparable to the work of laboratories of related faculties and professions. Also the role of the laboratory is that the originality of scientific research work, the introduction of new and innovating existing methods contribute to the advancement of existing knowledge from the mentioned and other relevant areas

The core work of the Laboratories in addition to teaching is related to scientific research and expert work in the field of agriculture, food technology and environmental protection. Existing equipment facilitates and facilitates the practical part of teaching, scientific research and professional work at the Biotechnical Faculty. One of the significant research activities of the laboratory is related to the control of food products. The laboratory possesses a large number of instruments for qualitative and quantitative analysis and acquisition of knowledge in the field of Food Technology

In a special laboratory there is an Atomic Absorption Spectrophotometer (AAS) for determining heavy metals and other food elements and a Microwave Reaction System, which enables faster sample preparation and accurate results for analysis on AAS.



Microwave Reaction System

Atomic Absorption Spectrophotometer (AAS)

Determination of fat in different types of food is done on the Soxlet apparatus SoxtecTM 8000 - FOSS. It is a closed system that performs automatic extraction.

Soxlet apparatus- Soxtec^{TM} 8000 - FOSS

Rotavapor® R-215 – Büchi

The rotary evaporator (Rotavapor® R-215- Büchi) is a device used in chemical laboratories to efficiently and slightly remove solvents from samples by evaporation.

Mass spectrometry of the core includes the movement of the test mixture, dissolved in the "mobile phase", through the "stationary phase", whereby the parts of the mixture are separated and isolated and can be analyzed and quantitatively determined. This device allows the amalgamation of fatty acids, amino acids, sugars, pesticides in food.

Spectomegtry of the core mass LC/MS/MS – BRUKER

Fourier Infrared Spectroscopy (FTIR) is a technique used to obtain an infrared spectrum of absorption or emission of a solid, liquid or gas. The FTIR spectrometer simultaneously collects high resolution data in a wide spectrum range. This method can quantitatively determine individual components in food.

FTIR Spectroscopy of advanced laboratory analysis

3.3. The procurement and instructions for use of instrumental equipment

For the purpose of developing and establishing a **"Food Quality Control Lab"** at the Biotechnical Faculty of the University of Bihac within the framework of the MSc project in Sustainable Food Production Systems / STEPS, a detailed specification of the instrumental equipment planned to be obtained was made. This specification implies purchasing the following equipment:

- Laboratory mill - Instrument for grinding and homogenizing foods and feeds
- Orbital laboratory shaker (VORTEX)
- Kjeldahl Distillation Solutions for Food and Feed - Automatic distillation unit
- Color measurement instrument whit data processor
- Analytical Instruments - Automated Titrators
- Moisture Analyzer
- pH measuring device - pH portable Food kit

Laboratory mill - Instrument for grinding and homogenizing foods and feeds

Laboratory mill will serve to prepare samples (grinding, milling and homogenizing samples of agricultural/food products of animal and cereal crops - application examples: hard, firm, fragile, soft, fibrous, oil and water samples). The prepared samples will be used in the further process for analyzes and determination of quality parameters of agricultural/food products (determination of fat - fatty acids, proteins - mineral amino acids, vitamins, fibers, carbohydrates, pesticides, toxins, heavy metals, etc.). This equipment will be an integral part of the MSc in Sustainable Food Production Systems (STEPS) for the purpose of developing laboratory exercises and preparation of student training materials, developing experiments, improving the existing level of knowledge in the field of analysis and quality control of food (nutritional products), analysis and control of agricultural products, herbal raw material, animal feed, quality control of animal feed, land analysis, water analysis, etc.

Orbital laboratory shaker - VORTEX

Orbital laboratory shaker - VORTEX (mixer or vortexer) is the instrument to be used for mixing sample solutions (preparation of samples) in various vessel types (eg Erlenmeyer flasks, tubes, etc.). Mixing is achieved by rapid circular or orbital motion. These prepared samples will be used in the further analysis and determination of the quality parameters of agricultural / food products (microbiological food safety, fat - fatty acid, protein - amino acids, minerals, vitamins, fibers, carbohydrates, pesticides, toxins, heavy metals, etc.), soil analysis, water analysis etc. The device will be an integral part of the subject (MSc in Sustainable Food Production Systems/STEPS) and will be used for the development of laboratory exercises and preparation of training materials student development, development of experiments, improvement of the existing level of knowledge in the area of quality control of food (food products), control of agricultural products, raw material of raw materials, animal feed, quality control of animal feed, soil analysis, water analysis,etc.

Kjeldahl Distillation Solutions for Food and Feed - Automatic distillation unit

Determination of protein content by Kjeldahl method.

Determination of protein by Kjeldahlu method is based on the assumption that all proteins contain on average 16% of nitrogen, and then, after degradation of organic matter, protein nitrogen is expressed as ammonia. Kjeldahl Distillation Solutions (Digestor 2508 Auto rack) is used for wet burning / oxidation of samples to determine the amount of nitrogen by Kjeldahl method. By destroying the sample with concentrating acid, the so-called " "Wet burning", whereby the organic part is destroyed in carbon dioxide and water and the azotamino group passes into ammonia with ammonia sulfate with the present acid. The water vapor distillation apparatus is used for the distillation of burnt samples determined by azot method by Kjeldahl but also for the determination of volatile acids, alcohols, sulfur dioxide, formaldehydes in causes of different origin. Amonics from ammonium sulphate are released by boiling with concentrated sodium bases, distilled and concentrated in a saturated solution of known molar acid. The ammonia is then determined by titration with hydrochloric acid. Amonics or nitrogen as a product of Degradation Protein (External titration - Analytical Instruments - Automated Titrators) is used to count the protein mass. Given the above mentioned **Kjeldahl Distillation Solutions for Food and Feed - Automatic Distillation Unit** will be used for determining protein in plant and animal products (cereals, milk, meat) and will be an integral part of the subject matter (curriculum development) at the II cycle of studies (MSc in Sustainable Food Production

Systems / STEPS), it will be used in the development of laboratory exercises and preparation of student training materials, development of experiments, raising existing level of knowledge and improving knowledge quality, increasing potential for scientific research in the field of food production, analysis and quality control of food (food products), analysis and quality control of agricultural products, raw material of plant origin, animal feed, quality control of animal feed,etc.

Analytical Instruments - Automated Titrators

Automated Titrators offer a simple and affordable solution for your routine titration applications. Superb components and technical know-how make this tiny instrument capable of performing any basic titration with ease. Accurate, repeatable and reproducible results are guaranteed thanks to precise burettes and sensors. Automated result calculations. Results are stored and available to print or transfer to the software.
The device will be used to detect peroxide, iodine number, acid level (acid level in milk and dairy products - determination of milk freshness, acid level in oils in oils), salt detection (NaCl, nitrite in meat and meat products), but also will be used directly in the development of laboratory exercises and preparation of materials for student training, development of experiments, upgrading of existing level and improvement of knowledge quality, increase of potential for scientific research in the field of food production, quality control of food (food products), quality control of agricultural products, herbal raw materials, animal feed, quality control of animal feed, etc. The device will be an integral part of the subject (MSc in Sustainable Food Production Systems / STEPS) curriculum. Automated Titrators will be automatically coupled with Kjeldahl Distillation Unit - external titration, and will also be used for protein determination.

Color measurement instrument (Chroma Meter whith data processor)

Color measurement instrument (handheld, portable measurement instrument) designed to evaluate the color of objects, particularly with texture, uneven surface conditions, or a lot of color variation. This high accuracy, reliable colorimeter helps users control the color quality, consistency, and appearance of their samples in a more efficient, streamlined process internally and throughout the supply chain. It accurately identifies color characteristics in objects, determines color differences between objects, and provides pass/fail assessments to immediately determine if the sample meets the defined standard. This Color measurement instrument is ideal for color inspections of food, within quality control, quality assurance, and R&D fields. It will serve to determine the color of meat, fish, fruit, vegetables, cereals, flour and other food and agricultural products in solid and liquid state. The color measurement instrument will be used directly in the development of laboratory exercises and preparation of materials for student training, development of experiment, increase of existing level of knowledge and improvement of knowledge quality, increase of potential for scientific research in the field of food production, quality control of food products, quality control of agricultural products , herbal raw material, animal feed, quality control of fodder. The color measurement instrument will be an integral part of the curriculum of the MSc in Sustainable Food Production Systems (STEPS).

Moisture Analyzer

The halogen moisture analyzer is a reliable solution for determining the moisture content in products to maintain quality and ensure optimum shelf-life. This halogen moisture analyzer is simple to use, even for untrained operators. With on-screen assistance and our free Moisture Guide, has everything you need to quickly setup and start making accurate moisture measurements. The device automatically determines moisture on the thermogravimetric principle where, due to pattern heating and water vaporization, the mass of the sample is reduced to a constant mass when the process is interrupted. Rapid determination of moisture content in various heat stable materials (eg samples of agricultural / food products, soil, fodder, etc., with a moisture content of greater than 0.1%). The device will be an integral part of the subject (MSc in Sustainable Food Production Systems/STEPS) and will be used in the development of laboratory exercises and preparation of materials for student training, experiment development, raising existing levels and improving the quality of knowledge, increasing the potential for scientific research in the field of food production, quality control of food, quality control of agricultural products, herbicide raw material, animal origin, quality control of animal feed, etc.

pH measuring device - pH portable Food kit

pH measuring device - pH portable Food kit. High quality data on the go, automatic sensor recognition, and calibration reminder ensure users obtain high quality data quickly and easily. Posebno je prikladan za korištenje na terenu i za mjerenja ubadanjem u djelomično tvrde medije (meso i mesni proizvodi). The device will be an integral part of the subject (MSc in Sustainable Food Production Systems / STEPS) and will be used in the development of laboratory exercises and preparation of materials for student training, experiment development, raising existing levels and improving the quality of knowledge, increasing the potential for scientific research in the field of food production, quality control of food (food products), control of agricultural products, raw material of raw materials, raw material of animal origin, quality control of animal feed etc. The device will be an integral part of the subject matter (curriculum) on II MSc in Sustainable Food Production Systems (STEPS).

Summary

The equipment to be procured will be combined with existing equipment installed in the Faculty of Biotechnology Laboratory, as soon as conditions for the creation of a modern and functional food quality control laboratory will be created. In this way, the Faculty of Biotechnology of the University of Bihać will provide the conditions for scientific staff to develop laboratory exercises, materials and experiments for student training in the field of sustainable food production systems, and to raise the existing level of knowledge and improve the quality of learning environments. Also, such a laboratory will provide an opportunity to increase the potential for scientific research, which will result in the publication of scientific papers in national scientific journals, international scientific journals and conferences. This laboratory will offer the possibility of organizing joint programs with industrial partners or small and medium-sized private sector companies and national bodies involved in decision-making and policy making. Considering the educational content of the MSc in Sustainable Food Production Systems/STEPS programme in particular, each of the laboratory exercises, experiments and training materials, will be include learning outcomes, a detailed description of the laboratory exercises, experiments and training materials, guidance and a description of the steps towards the successful implementation of the activity.

4. Development of the „**Food Production Systems Management Lab / ICT-center**“

4.1. Project activity

Through the provision of all necessary hardware and software for the launch of SimaPro software (SimaPro Faculty), develop and release the "Food Production Systems Management Lab (ICT-center)" at the Biotechnical Faculty of the University of Bihac, which will serve as a student training. ICT-center it will offer an opportunity for the students to design and analyse processes and supply chains and to evaluate the performance of production systems, in terms of energy consumption, and environmental impact.

4.2. Procurement and instructions for use of ICT equipment

For the purpose of developing and forming the Food Production Systems Management Lab / ICT-Center, for ICT equipment planned to be purchased, a detailed specification was made. This specification includes the purchase of the following equipment:

- Computer Configuration + Monitor
- SERVER Rack version 1U
- DSP WINDOWS SVR STD 2016, 2VM, 16 Core
- Laser printer A4
- UPS 19" RACK 1500VA
- Rack cabinet 19 "12U
- SWITCH 16 Ports
- White writing boards and presentation
- Swap panel
- SimaPro Software (SimaPro Faculty)
- Installation of equipment with networking and commissioning

The above-mentioned equipment will serve to realize the following project requirements:

- Provide terminal units for students with minimum bandwidth communication capacity,
- Provide a central server unit with high availability and sufficient performance for the SimaPro Faculty configuration and functionality,
- Provide communication between the server and the terminal,
- Ensure the ability to connect to the Internet as well as the ability to use a VPN,
- Provide the ability to use dynamic routing protocols for potentially binding with advanced and large networks of university campuses,
- Provide all necessary energy communication infrastructure for the needs of the lab,
- Provide a server communication wardrobe for the provision of server-communication equipment under the security lock,
- Provide all necessary software licenses,
- Ensure that the system can run at least 4 instances of the Operating System simultaneously,
- Ensure that the system works according to the principle of a minimum stateless failover high availability,
- The system is fully tested and demonstrated to work neat and stable on the day of delivery.

4.3. Procurement and instructions for use of LCA software

Purchased Licenses of advanced software tools (SimaPro Software) will be used for analysing processes and supply chain scenarios, in terms of supply chain management, energy consumption and environmental impact, and the evaluation of feasibility of basic and alternative scenarios.

About SimaPro Software

SimaPro helps effectively apply LCA (Life Cycle Assessment software) expertise, to help empower solid decision-making, change your products' life cycles for the better, and improve your company's positive impact. SimaPro is the professional tool to collect, analyse and monitor the sustainability performance data of your company's products and services. The software can be used for a variety of applications, such as sustainability reporting, carbon and water footprinting, product design, generating environmental product declarations and determining key performance indicators. (www.simapro.com)

SimaPro can:

- ✓ Easy modeled and analyzes complex life cycles in a systematic and transparent way.
- ✓ Measurees the environmental impact of products and services across all life cycle stages. Identifies the hotspots in every link of supply chain, from extraction of raw materials to manufacturing, distribution, use and disposal.

SimaPro Faculty (www.simapro.com/licences/faculty/)

SimaPro Faculty is a basic version of SimaPro for education. It comes as a single-user version (only one person can access a database or project at a time), but it can be installed on all Windows computers of department's students and staff.

Features

- Advanced product life cycle modelling with product stages
- Wide range of impact assessment methods included
- Inventory and Input/output databases included
- Analysis of groups
- Save inventory data as system processes
- Library switch
- Interactive network view
- Import data (.csv and SimaPro format)
- Export data (.xls and .txt format)

Quick results

SimaPro Faculty produce reliable results with limited ef-fort. Powerful software wizards assist in creating LCAs, while all results remain com-pletely transparent. SimaPro Faculty has the functionality needed to create basic LCA models, without compromising on the details.

Includes data and methods

SimaPro Faculty has all you need to get started right away. It includes a variety of methods and databases such as the renowned ecoinvent database. With SimaPro Faculty, can define how life cycle assessment results are presented: per process, per product stage or per function.

On different devices

SimaPro Faculty is a stand-alone version that can be installed on the PCs of all students and staff. It comes with a temporary licence that will expire after one year, and is the only version of SimaPro that can be installed as many times need. Software SimaPro Faculty - free Faculty license for students in non-OECD countries (BIH) free Faculty license is a temporary 12 months license but can be renewed as many times as needed, as long as the license is only be used for educational purposes.

Summary

Purchased ICT equipment will be used for the development of the Food Production Systems Management Lab (ICT-center), which will provide the conditions for scientific staff to develop materials and simulations for student training in the field of sustainable food production systems, and to raise the existing level of knowledge and improvement quality learning environment. This laboratory will offer the possibility of organizing joint programs with industrial partners or small and medium-sized private sector companies and national bodies involved in decision-making and policy making.Considering the educational content of the STEPS programme in particular, each trainning and simulation will be include learning outcomes, a detailed description of the simulation and training materials, guidance and a description of the steps towards the successful implementation of the activity. Scientific staff will be work on software-based exercises and projects, with the aim of exploiting the purchased facilities to the maximum degree and further improving the level of knowledge. Training material will be based on learning outcomes of the training /simulation level and will include a detailed description of the experiment/simulation, guidance and a description of the steps towards the successful implementation of the activity, samples as well as samples of the results and scenarios for additional exercises and research.

5. References:

1. *MSc in Sustainable Food Production Systems / STEPS, DETAILED DESCRIPTION OF THE PROJECT*
2. *www.simapro.com*

Attached;

Detailed equipment specification list:

"Food Quality Control Lab"	quantity	cost	currency
Kjeldahl Distillation Solutions for Food and Feed - Automatic distillation unit Automatic thinning, adding alkali, distillation and discharge pipes allow easy use. Variable steam generator increases application area to other volatile components. Official and accurate procedures (ISO, AOAC, EPA, DIN) simplify validation. Safe method for safe pipe distillation. Built-in security systems for user protection. Self-regulating cooling water regulation saves water and reduces costs. Automatic ignition of pumps for correct dispensing of reagents. Plastic-resistant aluminum holes and tube discharge bushes allow long life span. Addition of solution to the receiver solution. Automatic security doors. External titration (Mettler, Metrohm, Schott, etc.). Modularly upgradable to the analyzer and sampling system from multiple locations. Examples of official methods: EN ISO 5983-2 (AOAC 2001: 11) applicable to protein / nitrogen in raw materials, cereals, poultry, oil seeds, food for domestic use pets and fish. This standard is also a reference method for the determination of nitrogen / protein: Indirect spectroscopic determination (NIR / NIT), Combustion Method Dumas (ISO 16634). ISO 20483 determination of the proportion of nitrogen in cereals, and derived products ISO 8968-2 (IDF / FIL 20-2) Determination of the content of liquid milk nitrogen, complete or defatted, by the digestion principle ISO 8968-3 (IDF / FIL 20-3) determination of nitrogen content of liquid, whole or skimmed milk, semi-micro method ISO 8968-4 (IDF / FIL 20-4) Determination of non-protein content of liquid milk nitrogen, complete or defatted. ISO 937 (AOAC 981.10) Meat and meat products - Determination of nitrogen content (Reference method) Included items with the appliance: 1 pcs, 10000897, Stainless steel tube grip 1 pcs, 10000090, digestion tube 250 ml 1 pcs, 10000734, digestion tube 100 ml 1 pcs, 60027131, power cord Schuko-C19 1 pcs, 15220002, dosage flask 250 ml 4 pcs, 15640178, fuse 12A 250V 6.3x32mm (3AB) 1 pcs, 60022390, the rest of the pipe 6 m, 15820011, tubes reinforced with alkali 8 pcs, 15820051, Pipe clamp 1 pcs, 15820066, water pipe 3/4 "1/2" 194150500 * ACR AMONIUM SULPHATE 99.9995% 50 GR KJELTABS TABLETE CU 3.5 / 1000 *SR 210 Scrubber*: This semi-automatic, variable scrubber is used in the digestion phase for the neutralization of corrosive fumes. The diameter fills through a string before the entrance into the condenser *Digestor 2508 Auto rack*: Digestor 2508 Auto Rack 230V, Automatic Digestion 8-seater Excavation Unit EM 2508 Exhaust Unit for Digestor 2508 / DT208 250 and 400 ml tubes EM 2508 Exhaust Unit Installation: Installation of equipment according to the manufacturer's protocol, commissioning of the instrument, end-of-course training. Completion of IQ / OQ and work orders, delivery.	**1**	**16.970,00**	**EUR**

Analytical Instrument - Automated Titrators Application Type Potentiometric Burette 20mL , Number of Titration Methods: 3, USB-P25 printer; Pump; Temperature sensor, Parallel Titration: No, Acid/Base; Redox; Precipitation, PC Software (Optional), Sensor EG11-BNC sensor pH aqueous, Supported Stirrer Motors, User Interface iTitrate. SST - System suitability test which demonstrates whether the measurement system: pH / ion or conduktometer and electrode, suitable for planned measurement or testing, is substantially aligned with ISO17025: 2005; 5.5.2 and 5.5.5. The test must be performed by an authorized person with the issuance of a calibration certificate. Certified standards consistent with CSRM and NIST.	**1**	**4.030,00**	**EUR**
Color measurement instrument - portable colorimeters for measuring reflected colour and colour difference in a wide range data processor (microcomputer and printer in one) Handheld, portable measurement instrument designed to evaluate the color of objects, particularly with texture, uneven surface conditions, or a lot of color variation. Compatible with an optional data processor to print results on-site or software to record measurements and provide a more comprehensive color analysis. It is necessary that the device can accurately identifies color characteristics in objects, determine color differences between objects, and provides pass/fail assessments to immediately determine if the sample meets the defined standard (for color inspections of food, quality control, quality assurance, and R&D fields. Specifications: Calibration Plate, Wrist Strap, Data Processor, Protection cap, Cable (Head - DP), Color measurement instrument - Meter Head, AC-Adapter. Illuminating/viewing system: Wide-area illumination/0° viewing angle; specular component included), Display range: Y: 0.01% to 160.00% (reflectance), Battery performance, Approx. 800 measurements, Measurement/illumination area: ⌀ 50mm/ ⌀ 53mm, Color space/ colorimetric data: XYZ, Y x y, L*a*b*, Hunter Lab, L*C*h, Munsell (only illuminant C), CMC (l:c), CIE1994, Lab99,LCh99, CIE2000, CIE WI-Tw (only illuminant D65), WI ASTM E313 (only illuminant C), YI ASTM D1925 (only illuminant C), YI ASTM E313 (only illuminant C), User index (up to six can be registered from computer), Storable data sets: 1000 (measureing head and data processor save different data), Calibration channels: *120 channels (ch00: white calibration, ch01 to ch19 : user calibration), Operating temperature/Humidity Range: 0 to 40C, relative humidity 85% or less (at 35 C) with no condensation Optional equipment: CABLE Color Data Software - software to record measurements and provide a more comprehensive color analysis for color quality control.	**1**	**8.383,00**	**EUR**

Laboratory mill - Instrument for grinding and homogenizing foods and feeds The redesigned batch mill grinds hard, brittle, soft and fibrous materials for volumes up to 50 ml. Because samples may be embrittled directly in the grinding chamber; tough, oily and aqueous samples can also be grinded. The development of the mill placed particular emphasis on safety. The mill will only start when the lid is closed and can only be opened at standstill. A quick stop feature further increases the safety of the user. Test results of the new A 10 basic are comparable with the ones of the previous model A 10, due to the same grinding chamber, cutter geometrics and speed. Mill specifications: Digital timer, Counter: Display of grinding time, Interval function, Brushless motor for long service life and low noise level, Integrated cooling connections, Error code display, Simple handling with keypads, Easily exchangeable beater/cutter for a variety of applications, Grinding chamber reduction for small sample sizes and stainless steel cutter, Bayonet lock for lid to enable simple and safe locking Technical Data: Process type: batch, Operating principle: cutting/impact, Motor rating input: 300 W, Motor rating output: 240 W, Speed max: 25000 rpm, Speed deviation: 500 ±rpm, Circumferential speed max.: 73 m/s, Useable volume max.: 50 ml, Feed hardness max.: 5 Mohs, Feed grain size max.: 6 mm, Material beater/cutter: stainless steel, Material milling chamber: stainless steel, , Milling chamber can be cooled with water, Mill feed can be cooled in milling chamber with dry ice, Permissible ambient temperature: 5 - 40 °C, Permissible relative humidity: cca 80 %, Protection class according to DIN EN 60529: IP 41, Voltage: 220 - 240 V Frequency: 50/60 Hz, Power input: 300 W.	**1**	**2.045,00**	**EUR**
Moisture Analyzer Repeatability (sd) with 2g Sample 0.15 % Repeatability (sd) with 10g Sample 0.05 % Readability 0.01 %MC Storage 1 Method: 1 Result Drying Temperature: 50 °C – 160 °C Drying Programs Standard: Rapid Recommended Moisture Range: 1.0 - 100 %MC Result Handling Progress Indicator Switch-off criteria Timed: 1 Automatic (SOC 3) Test & Adjust Temperature (100/160): Weight Temperature Increments: 1 °C Display Mode: %MC; %DC; %AM; %AD; g Maximum Capacity cca 50 g	**1**	**1.600,00**	**EUR**
pH measuring device - pH portable Food kit FiveGo pH/mV F2-Food Kit with LE427 puncture pH sensor and carrying case. SST - System suitability test which demonstrates whether the measurement system is: pH / ion or conductor and electrode, suitable for planned measurement or testing, content compliant with ISO17025: 2005; 5.5.2 and 5.5.5. The test must be performed by an authorized person by issuing a calibration certificate. Certified standards followed by CSRM and NIST.	**1**	**600,00**	**EUR**

VORTEX - laboratory orbital shaker Vortex shaker suitable for short-time operation (touch function), activated by pressing shaker attachment or continuous operation. Wide speed range, infinitely adjustable. Different applications - interchangeable attachments and inserts e.g. Eppendorf tubes, microtiter plates, Erlenmeyer flasks 250 ml etc. Special strap for ensures easy handling of round/Erlenmeyer flasks. Sturdy cast casing and compact design. Operation activated touch function. Stable at high speeds (ultra high vibration damping). Eccentric with ball bearings. Suitable for continuous operation with low self heating thanks to self ventilation of motor. Shaking movement: orbital. Orbital diameter: 4 mm. Infinitely adjustable speed range: 500 - 2.500 rpm. Type of movement: orbital, Shaker diameter: 4 mm, Motor rating input: 58 W, Motor rating output: 10 W, Permissible ON time: 100 %, Speed min (adjustable): 500 rpm, Speed range: 0 - 2500 rpm, Operating mode: continuous operation. Working with microtiter plates - number of microtiter plates: 1, Permissible ambient temperature: 5 - 40 °C, Permissible relative humidity: cca 80 %, Protection class according to DIN EN 60529: IP 21, Voltage: 200 - 240 / 115 / 100 V, Frequency: 50/60 Hz, Power input: 60 W.	**1**	**480,00**	**EUR**
"Food Production Systems Management Lab / ICT-center"			
Computer Configuration - Brand name Installed OS: Windows 10 Pro 64 and MS Office 365 Computer case: Small Form Factor, max. 180W power supply Processor: Intel Core i3-8100 Processor (6M Cache, 3.6GHz) Memory: 8GB DDR4 2400MHz UDIMM Installed HDD: 1TB / 7200 rpm Optical Device: Slim DVD Recordable Graphics Card: Integrated Graphic Card Ethernet: Integrated Ethernet Speaker: Integral Internal Speaker Card Reader: 7 in 1 Card Reader Interface (mandatory): minimum 6 x USB 3.1 Gen1 full size ports, 4 of which are available directly from the front, minimum 2x USB 2.0 ports, 1 x serial, Option of additional serial and 1 parallel port from the manufacturer, 1 RJ-45, VGA, 2x Display Port, 2x PS / 2 ports, 3.5mm in front for headphone and microphone, on the back of the line-in (3.5mm), line-in (3.5mm) out (3.5mm), microphone (3.5mm). Possibility of simultaneous connection and operation of 3 independent monitors. Connection: USB Keyboard of the same manufacturer as PC Mouse: USB Optical Same Manufacturer as PC Documentation: - BiH / English Security: Access / Boot Access / Boot Access Control (CD, FDD access / boot control) Individual control of all USB ports via BIOS. The ability to record data on media via the USB port - "Smart USB Disable" Kensington security cable slot, preparation for mechanical lock. Guarantee: guarantee period min. of 3 years provided directly by the manufacturer to submit a statement of the manufacturer and authorized service in Bosnia and Herzegovina with a stock of spare parts in Bosnia and Herzegovina	**11**	**4.500,00**	**EUR**
Monitor "21.5" Monitor, same manufacturer as computer (items 1 and 2), IPS, 1920x1080, 250 cd / m2, Contrast 1000: 1, 7ms response time, 4ms (extreme mode), VGA, Display Port, tilt 22 ° back, -5 ° forward, guarantee period min. of 3 years provided directly by the manufacturer.	**11**	**1.400,00**	**EUR**

SERVER Rack version 1U Device Type 1U rack Server CPU: min. installed 1 x Xeon 4C E3-1240 v6 3.7GHz / 2400MHz / 8MB, expandable to 2 processors RAM: Minimum 16GB (2x8GB) DDR4 Memory PC4 CL15 19200MHz Hot-swap support Hard drives: Up to 8 (2.5 "") hot-swap SAS / SATA or SSD drives, Slim bay for DVD, Installed Hard Drives: Minimum 2 x 300GB 10K 2.5 '' SAS 12GBPS G3HS HDD Integrated RAID Controller: RAID-M5210 Server Expansion Slots (I / O): 2 slots on the board: 1 x PCI Express 3.0 x8 (LP), 1 x PCI. The riser slot riser card supports: 1 x PCI Express 3.0 x16 or PCIe 3.0 x8 (FH / FL), 1 x PCI Express 3.0 x8 (FH / FL), 1 x PCI Express 3.0 x8 or ML2 (FH / HL) LAN communication: 2 × 1 GbE (standard panel), Systems Management: Integrated Service Processor, Diagnostics via LEDs (Appropriate Light Signalization on External Front Panel with Independent Power Supply), Automatic Server Restart. System Fault Detection: System Fault Detection: Processors, Memory, VRM, Disks, Power Units and Blowers. Connections: minimum 1xVideo forward, 1xVideo back, 4xRJ-45, 2xUSB forward, 2xUSB back, 1 USB3.0 internal, SD Media Adapter with 2 blank SD Media Hot-swap components: Power units, fans for cooling system, hard drives. Power: Dual and Redundant. Computer case 1U rack, with all the necessary options for installation in a rack cabinet. Guarantee deadline: min. of 36 months, to provide the authorization of the equipment manufacturer and authorized service provider in Bosnia and Herzegovina who has or administers the warehouse of spare parts of the equipment manufacturer.	**1**	**2.300,00**	**EUR**
DSP WINDOWS SVR STD 2016 **2VM, 16 Core**	**1**	**715,00**	**EUR**

Laser printer A4 Device Type: Laser Printer Technology: Monochromatic Laser Technology (not Electro-photographic LED Technology) Print speed (A4, mono): minimum 33 pages per minute First page print time: at least 6.5 seconds Processor: 800 MHz minimum Installed memory: minimum 128MB Input paper capacity: minimum 250 sheets Standard ports: Centronics IEEE 1284 bidirectional parallel interface, Hi-Speed Certified USB 2.0 Specification (Type B), Ethernet 10 / 100BaseTX (RJ-45), with support for 1000Base-T Printer languages: Emulation of PCL 5e, PCL 6 emulation, Personal data printer stream (PPDS), PostScript 3 Emulation, Direct Image, Microsoft XPS (XML Specification Paper), AirPrint ™ Other: Energy Star Certified, CD / DVD Driver Included Warranty Period: 1 year with upgrade option, provided by the manufacturer work equipment and parts, submit the appropriate manufacturer 's or distributor and service that has a spare parts store in Bosnia and Herzegovina	**1**	**255,00**	**EUR**
UPS 19" RACK 1500VA 2U Rack or Tower, 1500VA 200-240V AC, In: IEC320 C20 (16A), Out: 8x IEC320 C13 (10A), Valve Regulated Lead Acid (VRLA), 9Ah Batteries, 10/100 Mbps Ethernet Port RJ-45 (on the NMC), Intelligent 5-button graphical LCD, USB, RS-232, UPS must be from the same manufacturer as the Server	**1**	**765,00**	**EUR**
Rack cabinet 19 "12U Light gray color (RAL 7035) The sides are detachable and locked Ventilation holes for passive ventilation Protection class IP 40 Safety glass door frame, 180 ° opening angle Rear door with locking capability Flexible hinges allow easy installation of doors or doors Load capacity up to 500 kg Adjustable profile 19 "" profile for depth, front and rear Large cable entry with rubber circular mechanism on the floor, as a protection against Cable glands with brushes Fully earthed Leveling feet adjustable to the level to level the uneven floors Roof ventilation module Incl. Set of 28 × 19 "" mounting screws Cable routing panel	**1**	**255,00**	**EUR**

SWITCH 16 Ports **16x 10/100/1000 Mbit, Fixed configuration, Desktop, 1U, Internal power supply**	**1**	**230,00**	**EUR**
White writing boards and presentation Writing board for offices and conference rooms. Ideal for writing ideas and presentations. The writing board combines functionality, elegant design and quality. It comes with a 30-year warranty. The durable surface allows the text to be clearly visible, that there are no scratches, it is simply clean and long lasting. The writing surface is magnetized, allows the use of magnets to consolidate the presentation or paper sheets directly on the board. The writing board has a thin aluminum edge in order to get as large a writing surface as possible. Protective corners of plastic prevents damage. The shelf comes in the frame so that the markers, wipers and cleaning liquids are always close to the hand. Product specification Height: 1200 mm Width: 3000 mm Material: Aluminum Function: With magnetic function Weight: 45 kg Approval: Recycled material	**1**	**347,00**	**EUR**
Swap panel **24 port switch panel CAT6a**	**1**	**125,00**	**EUR**
Installation of equipment with networking and commissioning Under the montage and networking of the equipment, the installation of the RO on the wall with the relevant equipment and the installation and networking of the computer equipment with the installation UTP cable CAT6a is approximately 200 m through 40x20 mm 40m (20 pcs) channels. At the same time, it is possible to predict 10 CAT6a cable lengths of 1m.	**1 (flat rate)**	**500,00**	**EUR**
Total EUR		**45.500,00**	**EUR**
Software SimaPro Faculty (www.simapro.com/licences/faculty/) - free Faculty license for students in non-OECD countries (Albania, BIH, Kosovo). Free Faculty license is a temporary 12 months license but can be renewed as many times as needed, as long as the license is only be used for educational purposes.			