Co-funded by the
Erasmus+ Programme
of the European Union

REPORT ON ORGANIZED SYMPOSIUM

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

PROJECT INFO

Project title	Strengthening of master curricula in water resources management for the Western Balkans HEIs and stakeholders
Project acronym	SWARM
Project reference number	597888-EPP-1-2018-1-RS-EPPKA2-CBHE-JP
Funding scheme	Erasmus+ Capacity building in the field of higher education
Web address	www.swarm.ni.ac.rs
Coordination institution	University of Nis
Project duration	15 November 2018 – 14 November 2021

DOCUMENT CONTROL SHEET

Work package	WP6 Dissemination and exploitation
Ref. no and title of activity	A6.2 Development of project website and promotional materials
Title of deliverable	Report on organized symposium
Lead institution	University of Nis
Author(s)	Milan Gocic, Maja Petrovic
Document status	Final
Document version and date	v01
Dissemination level	Public

VERSIONING AND CONTRIBUTION HISTORY

Version	Date	Revision description	Partner responsible
v.01	29/09/2021	Creation of the document	UNI

Contents

1. Introduction

This document reports the International symposium **"Water Resources Management: New Perspectives and Innovative Practices"** of the Erasmus+ Capacity Building in the Field of Higher Education project „Strengthening of master curricula in water resources management for the Western Balkans HEIs and stakeholders“ (SWARM), held on the 23rd and 24th September 2021. The symposium was chaired by Maja Petrović (UNS) and Milan Gocić (UNI). The symposium was organized as a hybrid event (in-person and online using Teams platform) technically supported by the IT sector of the Faculty of Technical Sciences, University of Novi Sad.

The symposium was organized by the University of Novi Sad (UNS) in collaboration with the consortium partners.

2. International symposium in general

The International Symposium was an interdisciplinary forum where the research results and best practices in the field of Water Resources Management (WRM) were shared with all SWARM fellows and stakeholders from the entire world. At the same time, the event was the place for the promotion of the achieved results under the SWARM project to a wider audience.

Effective results can be realized exclusively with active involvement, unbiased judgment and constructive input of all the innovation processes. In that context, topics were carefully selected to provide up-to-date issues and to encourage productive discussion bringing fresh and original insights and concepts at the forefront.

The symposium presented different interdisciplinary research experiences, in order to create a dialogue to point up solutions and synergies related to sustainable and fair water resources management, highlighting strengths, potentialities, and critical issues. Also, the symposium was a place to make a synergy between different areas in the water sector and between academia, business sector and policy making bodies.

The following topics were discussed:

- Water resources planning and management under uncertainty, climate variability and climate change,
- Risk assessment and management of hydrological hazards,
- Integrated modelling of water resources: new directions,
- Water resources management in transboundary river basins,
- Hydropolitics and Water governance: current issues and future perspectives,
- Complexity of water resources management in WB countries,
- Capacity building in water resource management in HEIs,
- Technological advances in water resources management: remote sensing and data science methods,
- Water supply and wastewater management technology,
- Desalination and water reuse: opportunities and challenges,
- River flow modeling,

- Water management infrastructure.

For the symposium whole organization two teams were defined (Table 1).

Table 1 Scientific and Organizational Committee members

SWARM Partner Institution	Scientific Committee	Organizational Committee
P1 – University of Niš (UNI)	Slaviša Trajković	Milan Gocić
P2 - University of Natural Resources and Life Sciences, Vienna (BOKU)	Michael Tritthart	Daniel Wildt
P3 - Norwegian University of Life Sciences (NMBU)	Zakhar Maletskyi	Susann Andersen
P4 - Aristotle University of Thessaloniki (AUTh)	Panagiotis Prinos	Harris Skoulikaris
P5 - University of Architecture, Civil Engineering and Geodesy (UACEG)	Maria Mavrova	Petar Filkov
P6 - University of Rijeka, Faculty of Civil Engineering (UNIRIFCE)	Barbara Karleuša	Bojana Horvat
P7 – University of Lisboa (UL)	Maria Manuela Portela	Rodrigo Proença de Oliveira
P8 – University of Novi Sad (UNS)	Srđan Kolaković	Maja Petrović
P9 – University of Sarajevo (UNSA)	Emina Hadžić	Hata Milišić
P10 - Dzemal Bijedic University of Mostar (UNMO)	Mili Selimotić	Marko Ćećez
P11 - Unversity of Pristina in Kosovska Mitrovica (UPKM)	Jelena Đokić	Gordana Milentijević
P12 - Technical College of Applied Science Urosevac-Leposavic (TCASU)	Predrag Stanojević	Jelena Rajović
P13 - University of Montenegro (UoM)	Goran Sekulić	Ivana Ćipranić
P14 – Public Water Management Company "Vode Vojvodine" (PWMC VV)		Olivera Gavrilović

In total 110 participants registered, 104 attended (43 in-person and 61 online) from 20 countries (Austria, Belgium, Bosnia and Herzegovina, Bulgaria, China, Croatia, Greece, India, Italy, Kazakhstan, Kosovo*, Montenegro, Norway, Portugal, Republic of Moldova, Serbia, Sri Lanka, the Netherlands, Uganda, Ukraine). In Figures 1-3 the number of participants at the symposium were presented.

Two representatives from the policy decision making bodies were participated in the event (Ministry of Environmental Protection of the Republic of Serbia and Directorate – General for the Environment). Five keynotes from the Netherlands, Norway, Greece and Italy presented the important topics in the field of water resources management. In total 19 out of 20 received papers were accepted for publication involving 51 authors. Presentations were prepared and showed by 39 panelists in 8 sessions.

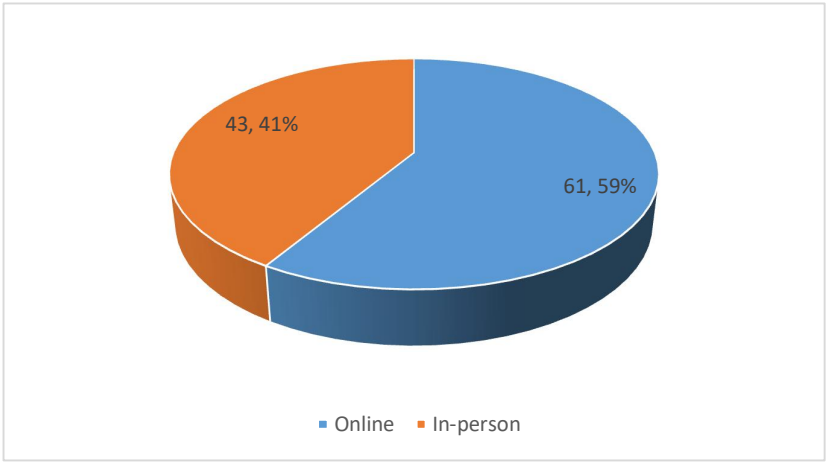

Figure 1 Number of participants at the International Symposium

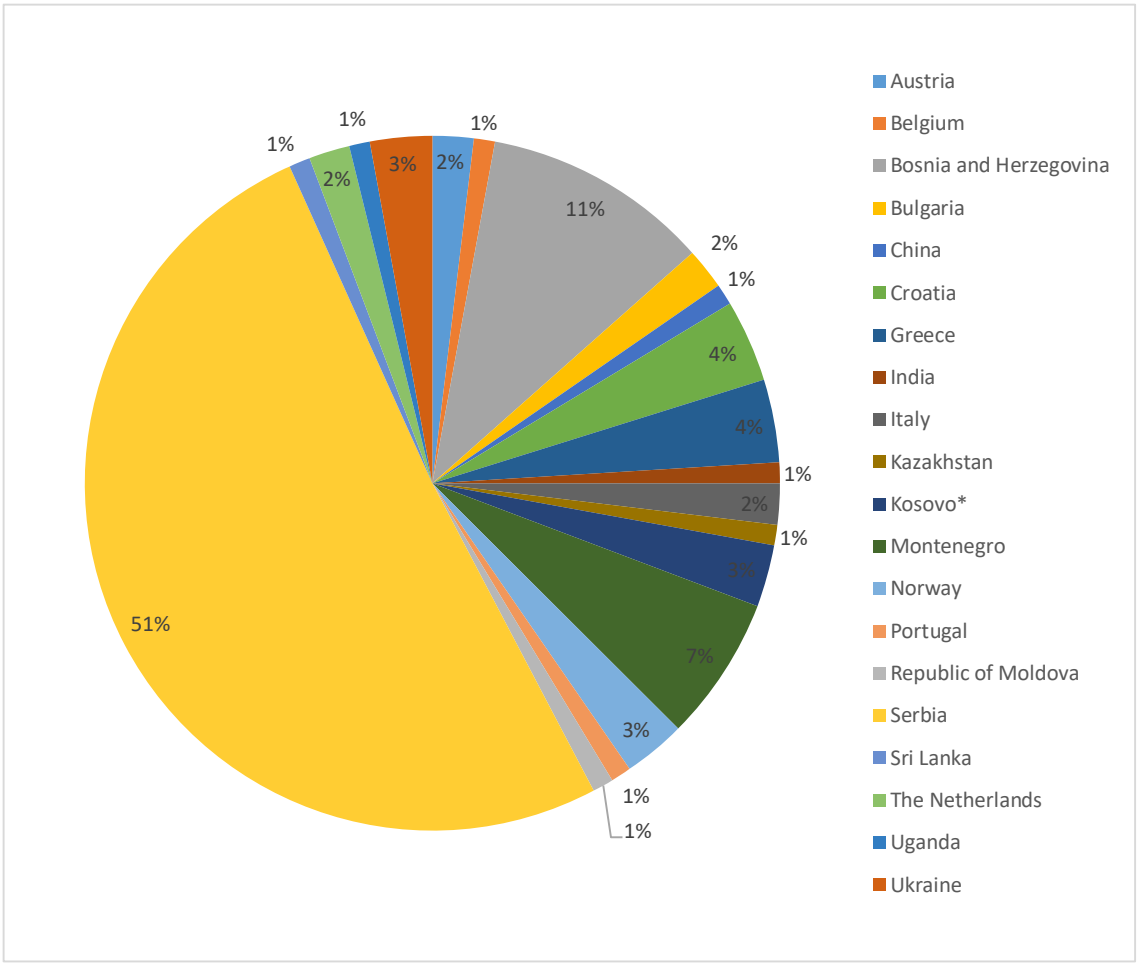

Figure 2 Number of participants per country represented in percentage

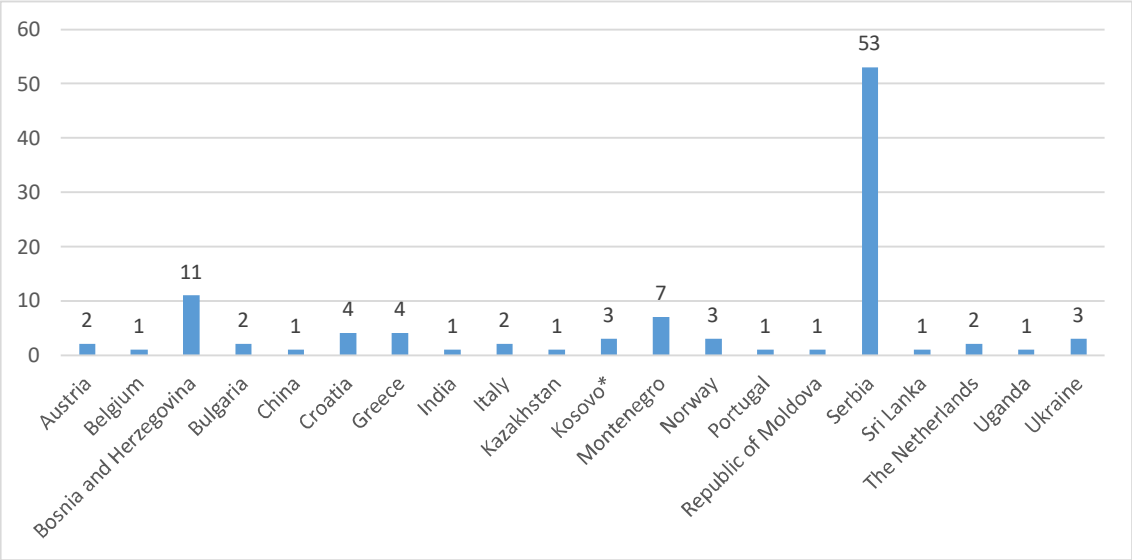

Figure 3 Number of participants per country

The registered participants were from different specialties i.e. water treatment (19.1%), water management (36.4%), water monitoring (18.2%) and other (26.4%) and from different professions i.e. academia, utilities, consultants, policy makers (Figure 4).

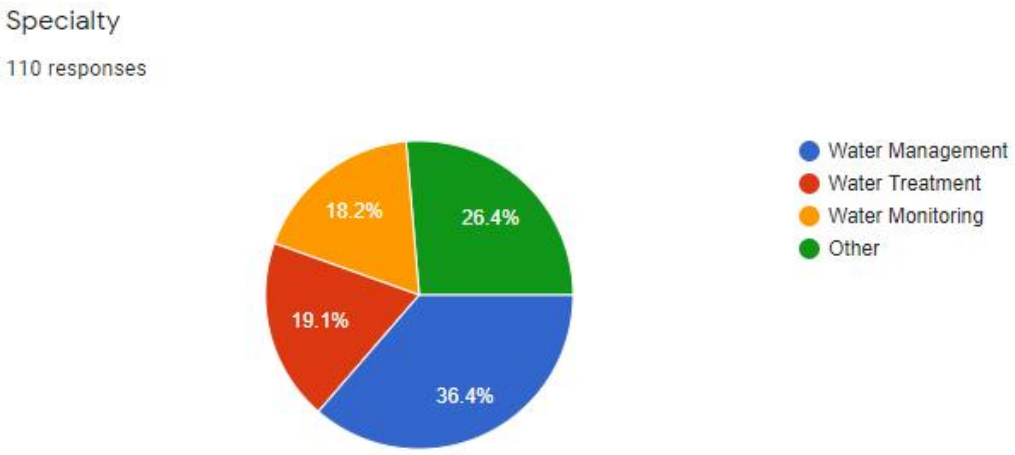

Figure 4 Specialty of registered participants

In total 81.8% of participants attended without paper and 18.2% attended with paper (Figure 5).

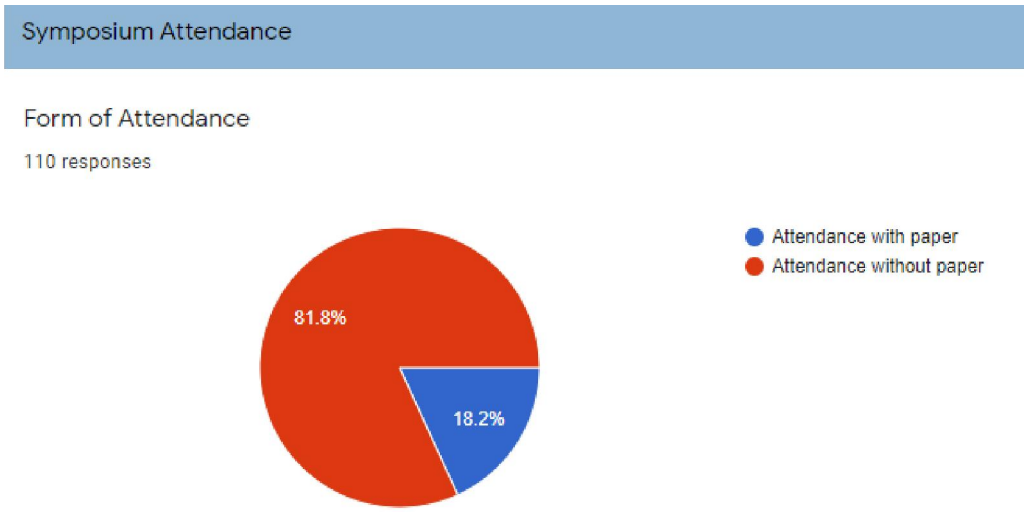

Figure 5 Attendance with/without paper

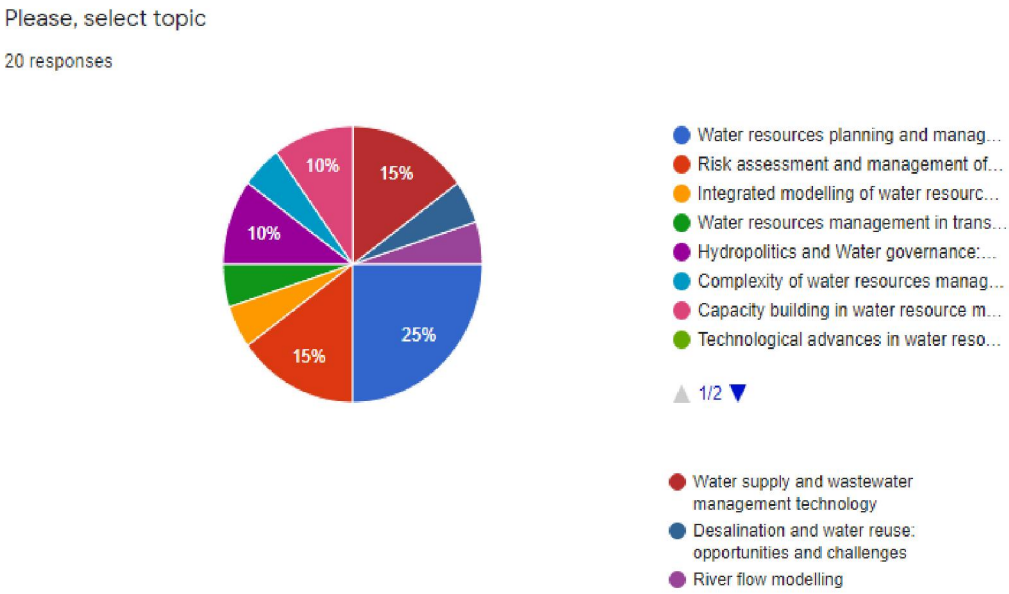

Figure 6 Attendance with/without paper

The following analysis is related to the received papers (Figure 6):

- Water resources planning and management under uncertainty, climate variability and climate change (25%),
- Risk assessment and management of hydrological hazards (15%),
- Integrated modelling of water resources: new directions (5%),
- Water resources management in transboundary river basins (5%),
- Hydropolitics and Water governance: current issues and future perspectives (10%),
- Complexity of water resources management in WB countries (5%),
- Capacity building in water resource management in HEIs (10%),

- Water supply and wastewater management technology (15%),
- Desalination and water reuse: opportunities and challenges (5%),
- River flow modeling (5%).

Institutions outside the consortium:

- Ministry of Environmental Protection of the Republic of Serbia
- Directorate – General for the Environment
- University of Messina
- University of Thessaly
- Delft University of Technology
- University of Peradeniya
- Ukrainian State University of Chemical Technology
- H2O-People / EJWP
- Municipality of Irig
- Republic Hydrometerological Service of Serbia
- doo "Vodovod i kanalizacija" Herceg Novi
- University Educons
- University of Kragujevac
- China Road & Bridge Corporation d.o.o. – CRBC Montenegro
- Jaroslav Černi Water Institute
- Technical University of Moldova
- Sultan Kudarat State University
- Public Health Institute of Sarajevo Canton
- Knjaževačka gimnazija
- Centurion University of Technology and Management
- National University of Water and Environmental Engineering
- ŠGD "HBŠ" Kupres d.o.o.
- Shenzhen Institute of Advanced Technology, CAS
- International Sava River Basin Commission
- Makerere University
- National university of water and environment engeneering

Symposium Chairs:

Maja Petrović, University of Novi Sad

Milan Gocić, University of Nis

First day, 23 September 2021

Moderators:

Emina Hadžić, University of Sarajevo

Jelena Đokić, Unversity of Pristina in Kosovska Mitrovica

Panelists:

Dejan Ubavin, University of Novi Sad

Ivana Hadži Stošić, Ministry of Environmental Protection of the Republic of Serbia

Vasileios Tyriakidis, Directorate – General for the Environment

Damir Brđanović, Delft University of Technology

Giuseppe Tito Aronica, University of Messina

Michael Tritthart, University of Natural Resources and Life Sciences, Vienna

Skoulikaris Charalampos, Aristotle University of Thessaloniki

Mili Selimotić, Dzemal Bijedic University of Mostar

Milan Gocić, Universitry of Nis

Ljiljana Jevremović, Universitry of Nis

Mladenka Novaković, University of Novi Sad

Milica Marković, University of Nis

Ayse Z. Aroguz, Istanbul University-Cerrahpaşa, Engineering Faculty

Marija Perović, Water Institute Jaroslav Černi

Zakhar Maletskyi, Norwegian University of Life Sciences

Slavka Bogdanova, University of Architecture, Civil Engineering and Geodesy

Mladen Milanović, University of Nis

Elvis Žic, University of Rijeka

Miljan Jeremić, Knjaževačka gimnazija

Summary:

Seminar started at 9:00 after the participant's registration and finished at 17:45. After each presentation, participants answered the questions.

Maja Petrović opened the welcoming session and gave the floor to **Dejan Ubavin** who presented the importance to be a part of similar international projects as well as advantages and benefits received from the participation in SWARM project.

Ivana Hadži Stošić represented current situation in Serbia in the field of environmental protection highlighting the green deal issues and harmonization in law between Serbia and EU in this field.

Vasileios Tyriakidis presented EU water policies and knowledge development between the EU commission and the Western Balkan region. He emphasized the need for making a consensus in future development in the field of smart water.

Milan Gocić presented the SWARM project - Strengthening of master curricula in water resources management for the Western Balkans HEIs and stakeholders highlighting the achieved results and working atmosphere.

Keynotes:

Damir Brđanović presented Global Sanitation Graduate School and especially MSc programme in sanitation and the following included topics: Analysis of sanitation flows, teamwork skills development, sanitation and public health, sanitation financing, governance, sanitation systems and services, leadership, behaviour change and advocacy, sanitation technology, emergency sanitation and project management.

Giuseppe Tito Aronica presented the topic related to the flood risk, resilience and resistance saying that flood risk management can be defined as the "*continuous and holistic societal analysis, assessment and mitigation of flood risk*" or as "*a process of continuous analysis, adjustment and adaptation of a flooding system (including both structural and non-structural actions) taken to reduce flood risk*". He highlighted urban floods typically stem from a complex combination of causes, resulting from a combination of meteorological and hydrological extremes, such as extreme precipitation and flows. However, they also frequently occur as a result of human activities, including unplanned growth and development in floodplains, or from the breach of a dam or an embankment that has failed to protect planned developments.

Session: **Strengthening water resources management in the Western Balkans**

This session was oriented to the promotion of the SWARM results to the wider public. The following topics were presented:

- Sharing innovative practices from the EU water sector to Western Balkans;
- Harmonising water resource management curricula between EU and Western Balkans;
- Lifelong Learning – a key to skills upgrade in the water sector;
- SWARM initiative – three successful years of collaboration in water resources management between EU and Western Balkans;
- Building sustainability in water resources management higher education;
- Communicating water resources management in Western Balkans: best practices and lessons learned.

Michael Tritthart presented how to share innovative practices from the EU water sector to Western Balkans. He concluded the following:

- **Curricula** developed and implemented on the basis of identified gaps in knowledge and EU innovative practices.

- Once also the **LLL courses** planned for practitioners will be in place, a functional framework of improving the knowledge in WB countries within the field of WRM is expected.

- This will contribute to **mitigating several weaknesses and threats** currently identified as major obstacles and **activate the strengths of the WB population**.

- Some factors identified as threats or weaknesses can be improved through soft-skills development – issues on the **level of politics** are outside the scope of a technically-oriented framework.

Panagiotis Prinos presented the topic regarding achieved harmonization of water resource management curricula between EU and Western Balkans. The strategy that was proposed to be followed for integrating innovation issues in the existing and new courses is interconnected with the principal aim of the current programme, i.e. the strengthening of master curricula by promoting innovative but also well-established approaches. The proposed strategy is based on two principal issues:

1) Utilization of knowledge produced during previous work packages and relevant actions, and

2) Continuous consultation with the project partners for the selection of approaches and the decision making processes.

A **Catalogue of competences** was developed (activity WP2.1) including Generic, Engineering and WRM competencies, which was used by the WB partners to correlate them with the various subjects.

The procedure for the development of curricula is consisted of the following 6 interconnected steps:

Step 1. The EU project partners created a report entitled as "EU Universities' Courses and Syllabi". In this report the relevant courses on the subject of Water Resources Management that are within the curricula of the EU Universities were identified and described. The report was used by the WB Universities as guidance to develop their own courses.

Step 2. The project partners concluded on the new courses as well as the updating of the existing courses.

Step 3. A common format for the description of the courses was agreed among the WB project partners.

Step 4. The WB partners proposed the syllabus of the proposed courses. A consolidated document that included all the syllabi was created and was sent to the EU partners for their comments and reviews.

Step 5. The EU partners proceeded in the review of the proposed courses, their content, objective and teaching outcomes. A consolidated review was sent to the WB project partners.

Step 6. The WB partners carefully deliberated the revised courses. Many comments were accepted, but there were also a lot of comments that couldn't be accepted, such as the change of the name of a course, since this is a process that needs approval at Ministerial level. In the final report a unique set of courses was produced.

Jelena Đokić presented Lifelong Learning as a key to skills upgrade in the water sector. During the training participants learnt about

- Water as a scarce resource,

- EU water policy under the Water Framework Directive,
- Water management and climate change adaptation,
- Wastewater treatment and reuse of treated wastewater,
- Flood and drought risk management,
- Innovation in the water sector.

The participants acquired the following knwledge, skills and competencies:

- understanding on climate change and its impact on water resources, and the EU Water policy
- to apply the best practices in water saving and water use,
- advance techniques for water and waste water treatments,
- measures for adaptation to the climate change in the given political framework.

The trainees will have the competencies to develop a Strategic plan for water management in all levels of administration as well in the companies in water sector

Mili Selimotić presented SWARM initiative – three successful years of collaboration in water resources management between EU and Western Balkans. He highlighted the importance of the SWARM project that is reflected in

a) **educational training for both teachers and students** since it encourages harmonization with the knowledge and skills of students in the EU countries and assists the mobility of students and teachers,

b) **cooperation for the preparation of teaching materials** with the development and implementation of innovative practices, exchange of good practices, ideas, joint initiatives to promote cooperation, and

c) **raising knowledge and awareness of the need for integrated WRM** by contributing to sustainable WRM in accordance with EU and domestic legislation and international agreements and conventions.

Milan Gocić presented how to build sustainability in water resources management higher education. Some conclusions:

- The capacity of WB HEIs should be further strengthened.
- HEIs should respond to the needs of industry through developing innovative training programmes.
- Study programmes should include the students' internships and implement the latest techniques in the teaching process.

Ljiljana Jevremović presented how to communicate water resources management in Western Balkans as well as best practices and lessons learned. Having the experience of three years of SWARM project realization the following conclusions can be made:

- Many professionals in the water sector are ready to expand their knowledge and learn from best practices.
- Young professionals to be encouraged to take advantage of contemporary services (social media, computer programs, etc.) to make progress within the field (knowledge transfer, networking, etc.).
- The lack of funding may reduce the interest of WRM professionals in new educational activities and innovative solutions in WRM.
- Ready-made products and services are more appreciated.
- A language barrier and lesser motivation is indicated for older and more experienced participants.
- Future advancements in local practices and education may be strengthen by networking of professionals and academics from the same and related fields within both, WB and EU countries.
- New ideas and knowledge emerge through the exchanged experiences between the professionals coming from different backgrounds (educational and locational).
- It is very important to communicate information and ideas in a clear and simple way, to avoid misleading and deceptions.

First session was oriented to six different topics and was chaired by Emina Hadžić:

- Water resources management in urban areas;
- Suitability assessment of photocataly tic treatment for pharmaceutical removal – Strength, weakness, opportunities and threats (SWOT) analysis;
- Water quality evaluation in Bovan reservoir for irrigation purpose;
- Wastewater treatment using halloysite/biopolymer nanocomposite;
- Tracing the nitrogen source in groundwater;
- Water quality assessment of rural water supplies otherwise and after the flood on the territory of the City of Kraljevo and the municipality of Vranjacka Banja.

Emina Hadžić presented water resources management in urban areas. She concluded the following:

- With the dramatic changes in the water cycle expected in the coming years, traditional and fragmented approaches to water resource planning are simply not good enough.
- It is clear that only an integrated approach to water management can solve the challenges of urban water - from water scarcity and climate extremes, floods, torrents, etc., to resource fragmentation, more water issues need to be addressed than ever before.

- The great potential lies in smart technologies that can help us make the right decisions faster.

- Advanced water management technologies can **efficiently collect, combine and analyze** complex data from a variety of sources **in real time**, which is one of the key factors **for making** urgent, **but good decisions**.

- Adopting the **Integrated Urban Water Management** (IUWM) concept and its iterative processes can help cities significantly increase the number of people with access to water of appropriate quantity and quality, improve rainwater drainage, to prevent urban flooding, increase climate change mitigation capacity, and improve health and productivity of resident cities.

Mladenka Novaković presented suitability assessment of photocataly tic treatment for pharmaceutical removal using SWOT analysis. She made the following conclusions:

- The diverse and complex nature of pharmaceutical pollutants has a significant impact on their removal efficiency in wastewater treatment plants.

- Photocatalytic technology with analyzed nanostructured mixtures has been proven to be an effective technology for decomposition of non-steroidal anti-inflammatory pharmaceuticals.

- With performed SWOT analysis for selected advanced oxidation method, many strengths were determined which can be mirrored through simplicity of nanomaterial preparation not demanding high energy consumption, stability of nanomaterials under simulated condition which include presence of inorganic constituents such as anions present in real wastewater and non-chemical usage. Besides numerous strengths, photocatalytic technology has a few drawbacks.

Milica Marković presented water quality evaluation in Bovan reservoir for irrigation purpose highlighting that reservoir water can be used for irrigation of crops that are moderately tolerant to the presence of salt in the water. It is recommended that measures should be taken in terms of reservoir management in order to improve the quality of irrigation water and consequently to increase number of crops to be threated.

Ayse Aroguz presented wastewater treatment using halloysite/biopolymer nanocomposite. She concluded that the modification process significantly increased the adsorption capacity of halloysite.

Marija Petrović presented tracing the nitrogen source in groundwater. To maintain the basic, autochthonous groundwater quality and to determine the vulnerability of groundwater to certain pollution the simultaneous complex analysis of agrotechnical, physico-chemical and hydrogeochemical data must be conducted. Nitrogen sources in groundwater under agricultural areas should be studied by simultaneous analysis of concentrations levels of O_2, NH_4^+, NO_3^-, TOC; changes in concentration levels of anthropogenic tracers B, Cl, Na; by examination of state condition parameters (pH, redox potential) and isotopic signatures of stable isotopes of nitrogen and oxygen.

Second session was oriented to six different topics and was chaired by Jelena Đokić:

- Predicting formation of disinfection by products under Climate Change uncertainties;

- Multi criteria analysis for prioritization of investments for reconstruction and modernization of irrigation infrastructure;
- Horizontal legislation in environmental protection, case study: Student participation in making a decision for water resource management;
- The fundamentals of risk assessments on the geohazard consequences;
- Overview of input data for quantitative risk analysis from the consequences of geohazard;
- Visualization of average annual precipitation in Serbia for the period from 1946 to 2019.

Zakhar Maletskyi presented Predicting formation of disinfection by-products under Climate Change uncertainties making the following conclusions:

- **Climate Change** will continue influencing NOM content in surface water, including cold climate zones. This will **increase risks of exposure to DBPs**, including THMs.

- **Rapid and online methods of DBPs surveillance** are desired in order to establish analysis routines and improve process control.

- **UV-VIS online spectroscopy** together with simply measured parameters can help to estimate THMFP and THM concentration in effluent.

- **Alarms over control limits** may trigger lab analysis or control measures.

Slavka Bogdanova presented multi criteria analysis (MCA) for prioritization of investments for reconstruction and modernization of irrigation infrastructure. This MCA approach can be used both in government and private sector assessments.

Mladen Milanović presented horizontal legislation in environmental protection. Student inclusion in the working bodies for the environmental protection of the city and municipalities increases the participation of young people in environmental protection and sustainable development. Students will have an opportunity to propose the solutions through learning and open conversations for the benefit of the entire local community. Student engagement is crucial for creating a society in which we would all like to live.

Elvis Žic presented the fundamentals of risk assessments on the geohazard consequences. For **adequate analysis of landslide hazard** it is necessary to conduct:

- a good geotechnical and engineering geological assessment,

- geomorphological and geographical analysis,

- political and economic perspective of the area development,

- economic and social circumstances in the analyzed area and

- know the factors influencing spatial and temporal variation of the threatening process.

The **accuracy of landslide hazard estimates** depends:

- on the quality and quantity of available data,

- the time spent collecting and processing data,
- conducting the necessary analyzes,
- the financial resources needed to investigate the elements needed to obtain input parameters.

As a result of the **landslide hazard assessment**, a landslide hazard map is made. It shows the spatial distribution of different degrees of landslide hazard.

Elvis Žic gave the overview of input data for quantitative risk analysis from the consequences of geohazard. **Three basic components for the risk of the consequences of geohazard:** hazard, exposure of at-risk elements and their vulnerability. The procedure for determining the risk analysis of geohazard consequences:

(i) **geohazard analysis** - includes analysis of intensity, probability of rock mass slip and its potential reach,

(ii) **identification of risk elements** - including number of occurrences, value and degree of exposure,

(iii) **vulnerability analysis** and

(iv) **risk assessment**.

The susceptibility to the occurrence of possible geohazards can be determined on the basis of geomorphological mapping, empirical or semi-empirical evaluation systems, as well as deterministic and statistical methods. **Methods for determining the propagation of debris flow and mudflow** - divided into two main categories, empirical and physical methods. **Empirical methods** - allow a rapid assessment of the propagation of debris flow and mudflow (the relationship of topographic slope factors and the length of the flow range). **Physically based methods** - complex methods that use numerical simulations of motion and propagation (expressed by the kinetic energy of hydrodynamic impact). **Geohazard zoning at national, regional and local scales** is carried out using simple methods based on heuristic or empirical procedures, unfortunately neglecting the time component. When assessing **hazard on a large scale**, it is proposed to adopt a quantitative method over a qualitative one, which separates the assessment of hazard and risk.

Miljan Jeremić presented the topic regarding visualization of average annual precipitation in Serbia for the period from 1946 to 2019. The spatial distribution of precipitation data can help us to better plan water resources. The obtained results can be useful for the planning and management of water resources and agricultural production. The presented application can be a part of the hydro-information system for drought analysing.

Second day, 24 September 2021

Moderators:

Barbara Karleuša, University of Rijeka

Naomi Timmer, H2O People

Zakhar Maletskyi, Norwegian University of Life Sciences

Panelists:

Elpida Kolokytha, Aristotle University of Thessaloniki

Chrysi Laspidou, University of Thessaly (Greece), Vice-president of research & technology – Water Europe (Belgium)

Harsha Ratnaweera, Norwegian University of Life Sciences

Luis Angel Espinosa, University of Lisbon

Charalampos Skoulikaris, Aristotle University of Thessaloniki

Borislava Blagojević, University of Nis

Milena Ostojić, University of Montenegro

Branislava Matić, Water Institute Jaroslav Černi

Ivana Sušanj Čule, University of Rijeka

Stevo Lavrnić, University of Bologna

Daniel Wildt, University of Natural Resources and Life Sciences, Vienna

Ivana Kovačić, University of Novi Sad

Ronald Semyalo, Makerere University, Uganda

S. B. Weerakoon, University of Peradeniya, Sri Lanka

Summary:

Seminar started at 9:00 after the participant's registration and finished at 15:45. After each presentation, participants answered the questions.

Keynotes:

Elpida Kolokytha presented green development and water resources management. Water resources management goes beyond the "water science". Universities should be used as communication platforms to create a more effective dialogue between public authorities - Industry and academia on sustainable water management and green development at different levels.

Chrysi Laspidou presented the topic regarding climate-resilient regions through systemic solutions and innovations and highlighted that we should understand the processes and consequences of climate change. Because of that people, problems and solutions should be connected in a systemic approach.

Harsha Ratnaweera presented how to manage risks from digitalisation in the water sector. Strategic principles for secure water sector against cyber threats are:

1. Understand threats: Build on our joint work to develop our shared understanding of the cyber threats facing the water sector as they evolve.
2. Manage risks: Develop and implement approaches to manage risks and address cyber security vulnerabilities in the water sector, now and in the future.
3. Manage incidents: Respond effectively, with industry, to any serious cyber incidents, including those that compromise critical water infrastructure.
4. Develop capabilities: The government and sector enhance the cyber skills and capabilities of the water sector to meet future needs.
5. Strengthen collaboration: Strengthen collaboration between government and the water sector and within the water sector.

Third session was oriented to six different topics and was chaired by Barbara Karleuša:

- Perspectives of a climate crisis: higher risks from global to a small island environment;
- Simulation of ungauged basins in climate change conditions;
- Nature based stormwater management solutions for housing area – Case study of roof garden implementation;
- Possibilities of application of HEC RAS two-dimensional models for prediction of bridge pier scour;
- Natural water retention measures contribution to integrated transboundary Tisza River basin management-environmental and flood risk management objectives synergy;
- Master's thesis in the field of hydrotechnical engineering at the Faculty of Civil Engineering (University of Rijeka) – Good practice examples.

Luis Angel Espinosa presented perspectives of a climate crisis. The coupling of the results from the research with other published studies over the past sixty years provides evidences that in Madeira Island:

(1) seasonal and annual rainfall has shown a gradual decrease since the late 1960's with the uncertainty regarding to whether rainfall will continue to decrease or it will counterbalance the already experienced rainfall deficits;

(2) the variability of seasonal and annual rainfall is highly correlated with the large-scale atmospheric circulation pattern of NAO;

(3) droughts in the island have become worse (higher magnitude and longer duration in recent years); and that

(4) extreme rainfall is clearly intensified by the persistent changes in the NAO mainly during negative NAO phases (recently more recurrent and "extreme").

Charalampos Skoulirakis presented simulation of ungauged basins in climate change conditions. The sensitivity analysis during the calibration process of the hydrology model at the case study ungauged basin, demonstrated the importance of optimum estimation of channel losses, a parameter

that cannot be accurately assessed by the SCS Curve Number method that is applied for estimating the losses in the subbasins. In terms of climate change and future runoff, the outputs showed that there is not a clear discharges' trend and the outputs depend on the RCM that is used for triggering the hydrologic simulation. At seasonal scale, all simulation outputs agree on decreased runoffs during late summer and early autumn, while varying runoff increases are presented during the winter. For most of the future 20-year periods, it can be concluded an increased number of anhydrous days (lack of discharge) together with an increased duration of these incidents. Additionally, for almost all periods and climate models, the maximum runoff is quite bigger than the one observed in the past.

Borislava Blagojević presented nature based stormwater management solutions for housing area – case study of roof garden implementation. Public benefit from roof garden implementation:

1. Lessening stress from the combined wastewater system;
2. Lowering risk of pluvial flooding;
3. Quantification of benefits through cost estimate of roof runoff volume sanitation at WWTP possible.

Recommendations:

- To include roof gardens as technical elements in SWM system preliminary design approach.
- To investigate implementation of roof gardens in the urban retrofitting design process.

Milena Ostojić presented possibilities of application of HEC RAS two-dimensional models for prediction of bridge pier scour. Various empirical equations for evaluation of local scour around bridge piers have been developed. Most commonly used variables include: flow depths (in the bridge profile), flow velocities, shear stress, Froude number and Reynolds number as an indicator of turbulence. Two-dimensional hydraulic analysis in specialised software for open flow modeling (such as HEC RAS) can provide useful and more realistic values of basic hydraulic flow parameters. Model calibration and verification are necessary in order to use the model for predictive purposes.

Branislava Matić presented natural water retention measures (NWRM) contribution to integrated transboundary Tisza River basin management-environmental and flood risk management objectives synergy. Integration of the win-win measures associated to flood risk management that might lead to achieve the objectives of WFD in the Tisza River Basin in the updated ITRBM reinforce synergy between flood risk management and environmental objectives. Proposed measures are extracted from the national catalogues of measures and in line with measures reported in the Flood Risk Management Plan for the Danube River district. Given the multi benefits of the NWRM, their identification enhances Tisza countries cooperation with respect to transboundary water management visions and objectives, improve integrated water resources management, and support cooperation among various sectors relevant for flood risk and water resources planning and management.

Ivana Sušanj Čule presented master's thesis in the field of hydrotechnical engineering at the Faculty of Civil Engineering (University of Rijeka) – good practice examples. She highlighted the need for the enhancement of the teaching, scientific, and professional activities due to moving to new building and laboratories. Development of the work with students is visible especially in the quality of

the master's theses in the last six years as well as in practical and scientific articles that are published in cooperation with students. The civil engineering industry demands all kinds of a different profiles of civil engineers, therefore is necessary to adapt study programmes and learning outcomes according to the market development and needs and as well to satisfy student's interests and affinities. Students have a lot of different topics to choose from and if they want to, they can also do their theses through the student ERASMUS or CEEPUS mobility programs in other HE institutions.

Session: Young professionals in the water sector was chaired by Naomi Timmer and four networks were presented:

- Young Water Professionals chapter in Serbia;
- IAHR Young Professionals Networks;
- European Junior Water Programme;
- UNESCO's Intergovernmental Hydrological Programme (IHP) Phase Nine (IHP IX): Priority Areas and the contribution of UNESCO Chairs.

Stevo Lavrnić presented Young Water Professionals (YWP) chapter in Serbia. The water sector needs to invest in recruitment and development of young people, giving them opportunity to grow professionally and become future water leaders. The YWP community is a dedicated group within the International Water Association (IWA) Network where many activities are organised by, and for, young IWA members (aged 35 years and below). The objectives of the Serbian chapter are:

- To establish a network of young people who work/study in the Serbian water sector.
- To empower Serbian YWPs and enable them to solve problems and make the necessary changes.
- To cooperate with other YWP chapters and national and international subjects.

Daniel Wildt presented IAHR Young Professionals Networks. IAHR YPN membership benefits are

- reduced IAHR membership fees,
- reduced registration fees for IAHR events,
- free digital access for IAHR journals,
- discounts on books/monographs by IAHR and Taylor & Francis,
- article publishing charge waivers.

Naomi Timmer presented European Junior Water Programme. Added value to organisations and the water sector are

- Support and empower employees through skill development.
- Break through other existing water silos.
- Adapt as an organization to the common challenges and trends.
- Create a better understanding and cooperation network for the future.

Added value to young water professionals are

- Play an important role in the future of a Water Smart European Society.
- Develop Professional, Personal skills and Leadership through training programmes.
- Through input of a "real" case within your organisation, creating new knowledge together.

Skoulikaris Charalampos presented UNESCO's Intergovernmental Hydrological Programme (IHP) Phase Nine (IHP IX). The IHP-IX priority areas, identified and elaborated by UNESCO's Member States, are presented as five transformative tools that will enable water security to sustain development in a changing world for the period 2022-2029:

1. Scientific Research and innovation,

2. Water education in the Fourth Industrial Revolution including Sustainability,

3. Bridging the data-knowledge gap,

4. Inclusive water management under conditions of global change,

5. Water governance based on science for mitigation, adaptation, and resilience.

Session: **Partnerships for sustainable management of water resources** was chaired by Zakhar Maletskyi and four networks were presented:

- Water Harmony – a global partnership for water education and research;
- SENVIBE – Strengthening educational capacities by building competences and cooperation in engineering subjects;
- WaSo Africa – Promoting value of water through international cooperation;
- Harmonising teaching and pedagogical approaches in water related graduate education between Asia and Europe.

Harsha Ratnaweera presented Water Harmony – a global partnership for water education and research. He pointed out the following

- Build a group with strong and dedicated members (PostDocs, Admin secretaries, PhDs, MScs).

- Find a colleague who can take over you when the time is approaching.

- Social networking is crucial, especially when you can't compete with financial benefits from other projects.

Ivana Kovačić presented strengthening educational capacities by building competences and cooperation in engineering subjects and highlighted the most important achieved results.

Ronald Semyalo presented WaSo Africa – promoting value of water through international cooperation and lessons learnt:

- Enhanced abilities of Partners in south to manage multi-partner, multi-year projects.

- Collaboration lends to risk management for instance, if one partner unable to proceed due to civil strife, continuity can still be achieved.

- Great potential for South – South (Africa – Asia – Africa) tha needs to be tapped into.
- Short term fellowships cost effective way of supporting students in home country, effective in helping staff strengthen credentials – Many junior staff on project were promoted or recruited.

S. B. Weerakoon presented how to harmonise teaching and pedagogical approaches in water related graduate education between Asia and Europe.

At the end of the symposium Milan Gocić made final remarks.

The presentations can be downloaded from http://www.swarm.ni.ac.rs/activities?id=90.

3. Symposium evaluation

The symposium evaluation form had the following questions:

- Relevance of the topic (Figure 7),
- Usefulness of the acquired knowledge (Figure 8),
- Rating of presented materials (Figure 9),
- Rating organization (Figure 10),
- Rating of working conditions (Figure 11),
- Rating interactivity in symposium (Figure 12),
- Assessing the fulfilment of expectations regarding symposium (Figure 13),
- Overall impression (Figure 14).

In total 43 responses were received. The general conclusion is that the symposium had an excellent logistic and that the quality of presented material was very good. Some opinions (comments):

- Thank you for having me!
- Congratulation to the organizers of the symposium
- Excellent organised event.
- It was mz pleasure to participate.

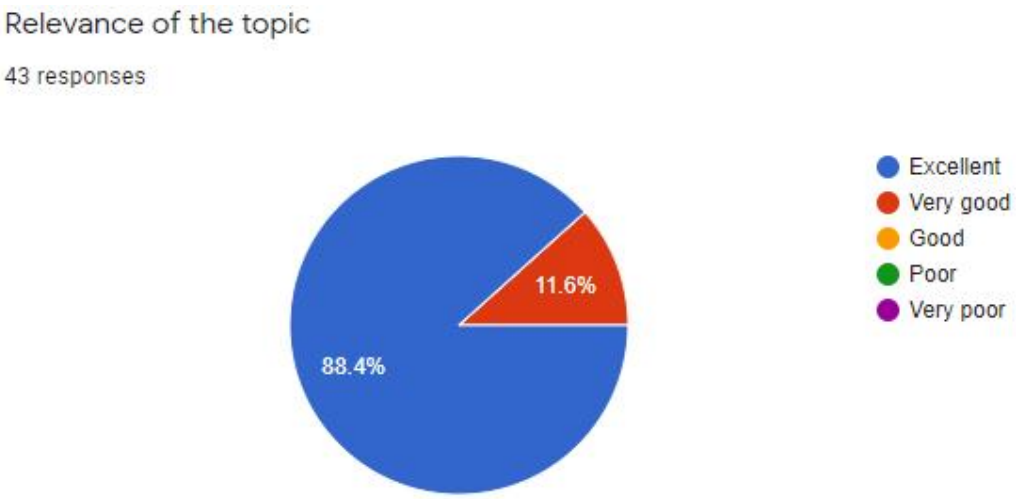

Figure 7 Relevance of the topic

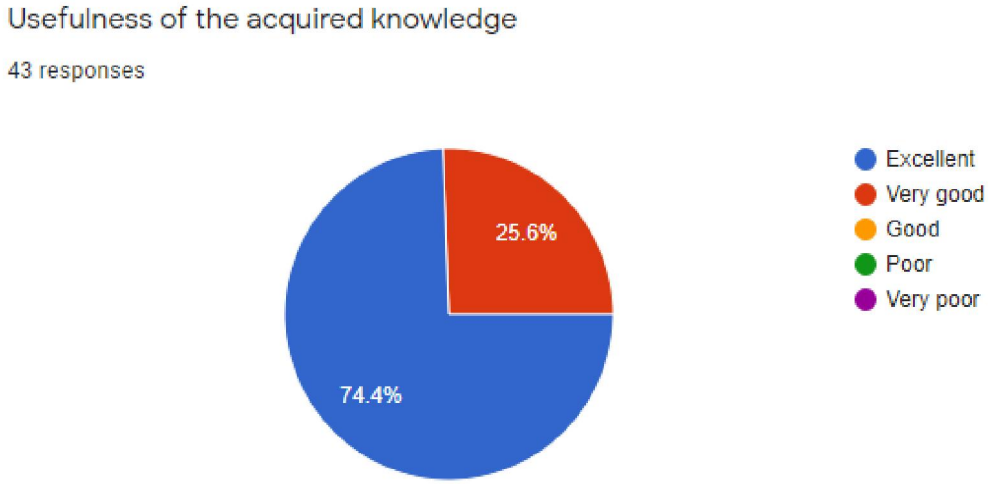

Figure 8 Usefulness of the acquired knowledge

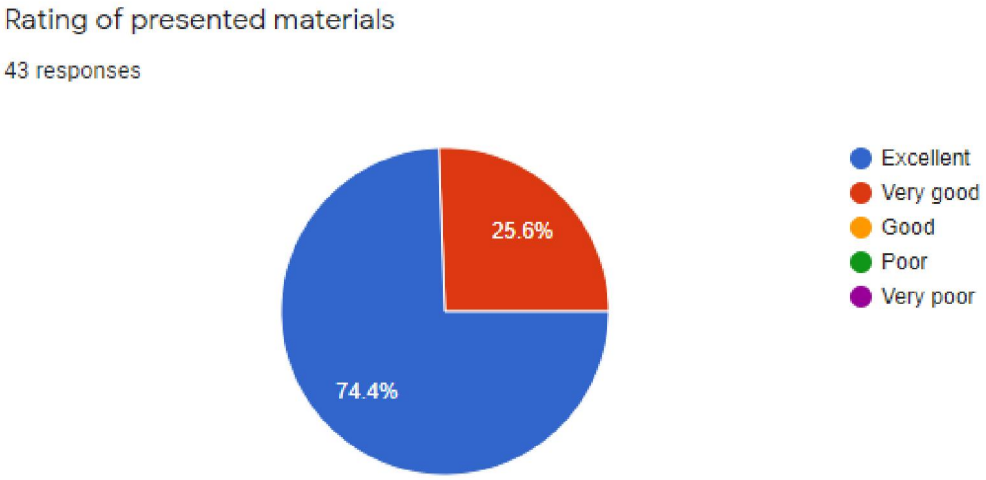

Figure 9 Rating of presented materials

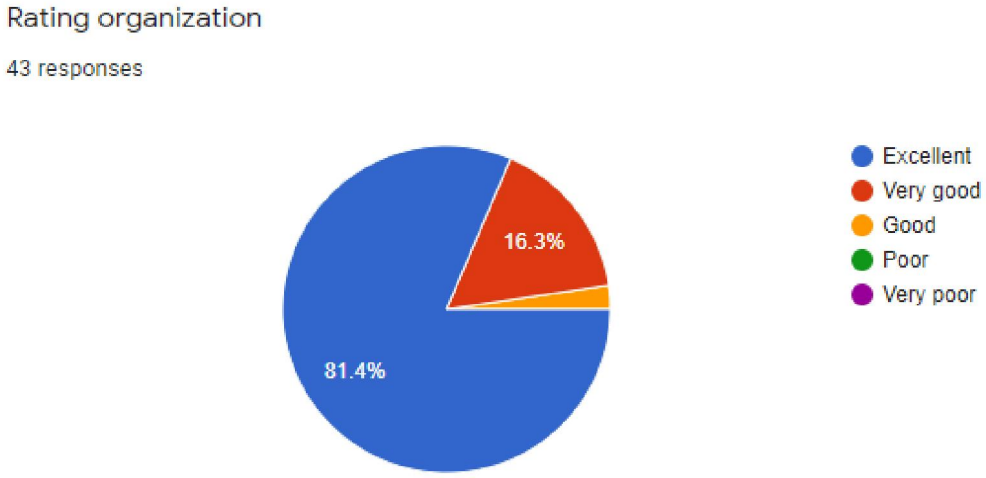

Figure 10 Rating organization

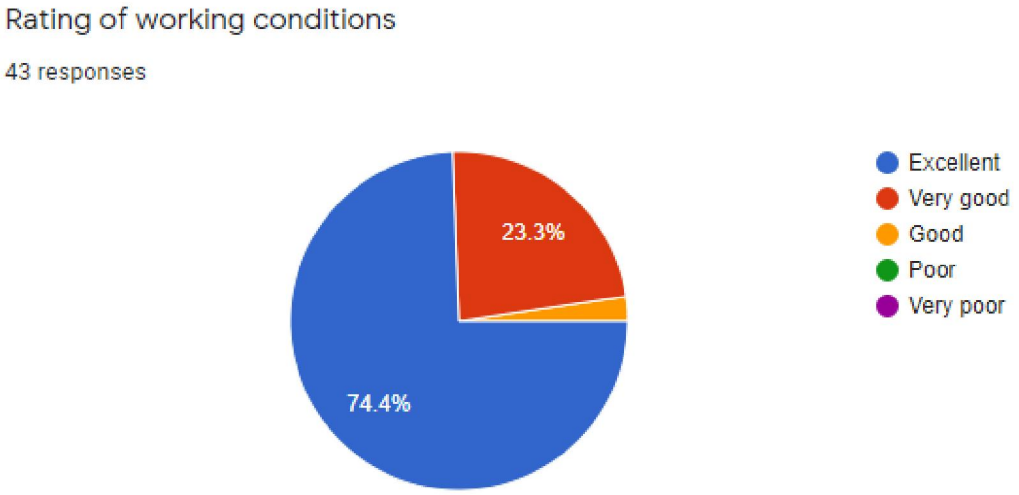

Figure 11 Rating of working conditions

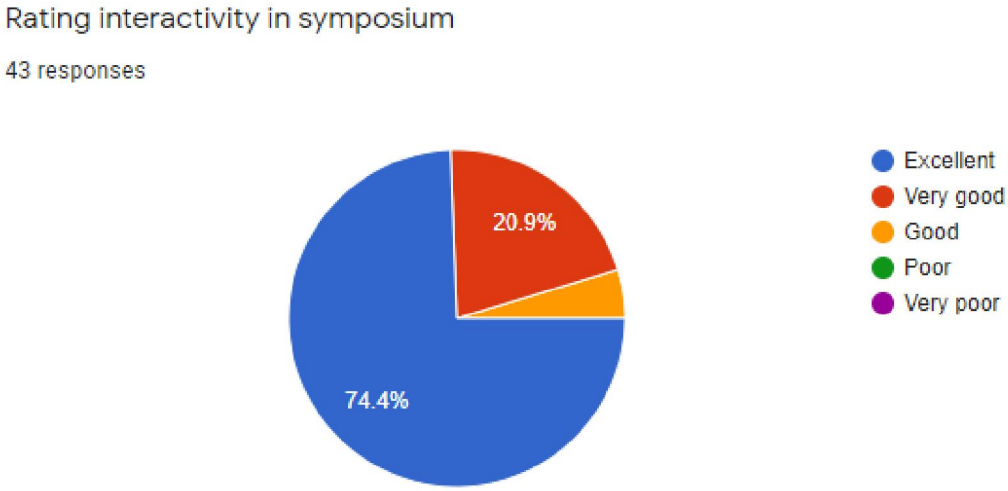

Figure 12 Rating interactivity in symposium

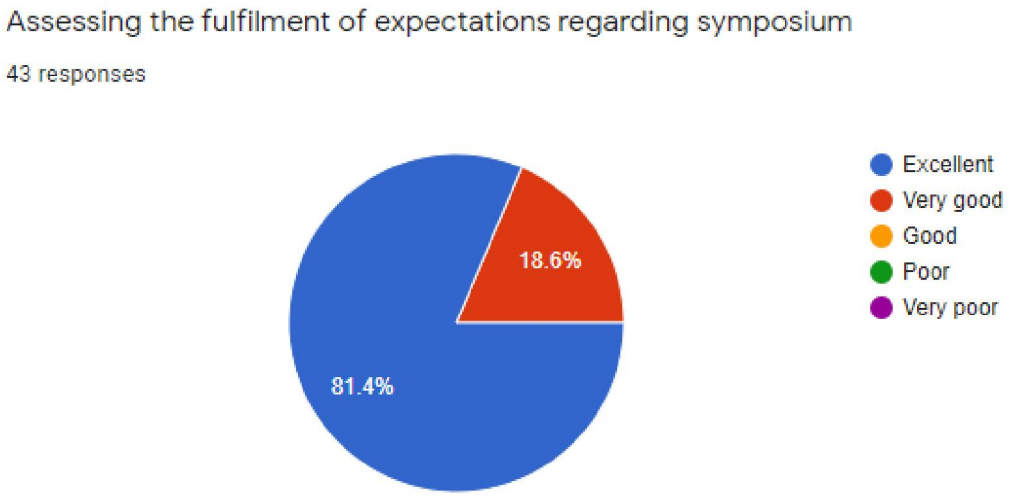

Figure 13 Assessing the fulfilment of expectations regarding symposium

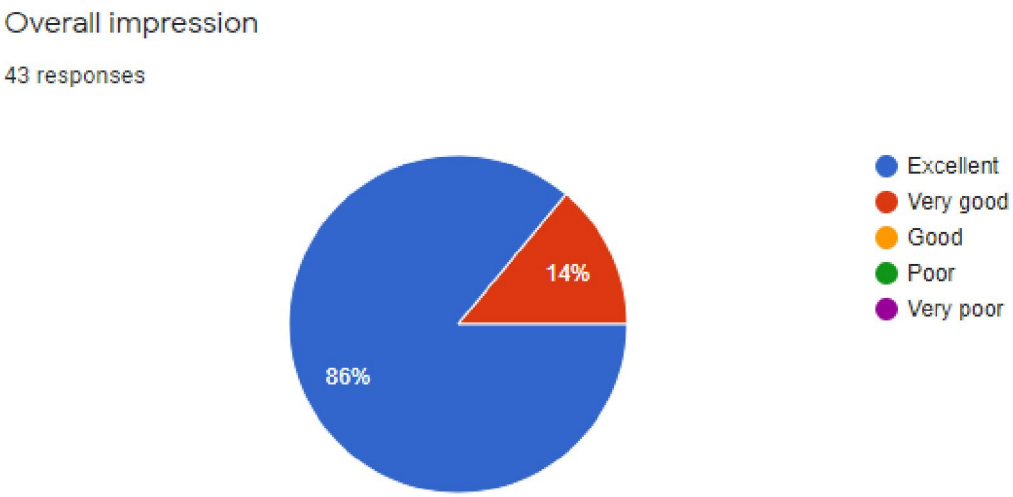

Figure 14 Overall impression

ANNEX I – Symposium agenda

Water Resources Management:
New Perspectives and Innovative Practices

International Symposium

23-24 September 2021, Novi Sad, Serbia

Venue: University of Novi Sad

Time zone: CEST (UTC+2)

Thursday, 23rd September 2021		
University of Novi Sad, Faculty of Technical Sciences		
08:30-09:00	Participant's registration	
Opening session		
09:00-09:10	Opening message from the University of Novi Sad	Dejan Ubavin, University of Novi Sad, Faculty of Technical Sciences
09:10-09:20	Ministry of Environmental Protection of the Republic of Serbia	Ivana Hadži Stošić, State Secretary
09:20-09:40	EU water policies and knowledge development between the EU commission and the Western Balkan region	Vasileios Tyriakidis, PhD, Policy Officer, Clean Water, Directorate – General for the Environment
09:40-10:00	Water resources management in Western Balkans: challenges and opportunities	Milan Gocić, Coordinator, SWARM project, University of Niš
Keynotes		

10:00-10:20	Global Sanitation Graduate School	Prof. Damir Brđanović, Delft University of Technology
10:20-10:40	Flood Risk, Resilience and Resistance	Prof. Giuseppe Tito Aronica, University of Messina
10:40-11:00	Break	
Strengthening water resources management in the Western Balkans		
11:00-11:20	Sharing innovative practices from the EU water sector to Western Balkans	Michael Tritthart, University of Natural Resources and Life Sciences, Vienna
11:20-11:40	Harmonising water resource management curricula between EU and Western Balkans	Skoulikaris Charalampos, Panagiotis Prinos, Aristotle University of Thessaloniki
11:40-12:00	Lifelong Learning – a key to skills upgrade in the water sector	Jelena Đokić, Unversity of Pristina in Kosovska Mitrovica Olivera Gavrilović, Jelena Vojvodić, Public Water Management Company "VodeVojvodine"
12:00-12:15	Break	
12:15-12:30	SWARM initiative – three successful years of collaboration in water resources management between EU and Western Balkans	Emina Hadžić, University of Sarajevo Mili Selimotić, DzemalBijedic University of Mostar Goran Sekulić, University of Montenegro
12:30-12:45	Building sustainability in water resources management higher education	Milan Gocić, Universitry of Niš Jelena Rajović, Academy of Applied Sciences of Kosovo and Metohija Maja Petrović, University of Novi Sad
12:45-13:00	Communicating water resources management in Western Balkans: best practices and lessons learned	Ljiljana Jevremović, Universitry of Niš Slaviša Trajković, Universitry of Niš

13:00-14:00	Lunch	
First session **Session Chair**: Emina Hadžić, University of Sarajevo		
14:00-14:15	Water resources management in urban areas	Emina Hadžić, Hata Milišić, Suvada Šuvalija
14:15-14:30	Suitability assessment of photocataly tic treatment for pharmaceutical removal – Strength, weakness, opportunities and threats (SWOT) analysis	Mladenka Novaković, Ivana Mihajlović, Goran Štrbac, Dragana Štrbac, Maja Petrović
14:30-14:45	Water quality evaluation in Bovan reservoir for irrigation purpose	Milica Marković, Mladen Milanović, Slaviša Trajković
14:45-15:00	Break	
15:00-15:15	Wastewater treatment using halloysite/biopolymer nanocomposite	Davut Lacin, Vesna Teofilović, Sezen Kucuk, Jelena Pavličević, Ayse Z. Aroguz
15:15-15:30	Tracing the nitrogen source in groundwater	Marija Perović, Vesna Obradović, Branislava Matić, Dragica Vulić
15:30-15:45	Water quality assessment of rural water supplies otherwise and after the flood on the territory of the City of Kraljevo and the municipality of Vranjacka Banja	Irma Dervišević, Almin Dervišević, Milica Tomović, Jovana Galjak
15:45-16:00	Break	
Second session **Session Chair**: Jelena Đokić, University of Pristina in Kosovska Mitrovica		
16:00-16:15	Predicting formation of disinfection by-products under Climate Change uncertainties	Zakhar Maletskyi, Harsha Ratnaweera
16:15-16:30	Multi criteria analysis for prioritization of investments for reconstruction and modernization of irrigation infrastructure	Slavka Bogdanova, Petar Filkov
16:30-16:45	Horizontal legislation in environmental protection, case study: Student participation in making a decision for water resource management	Zorica Filipović, Ivana Lukić, Mladen Milanović

16:45-17:00	Break	
17:00-17:15	The fundamentals of risk assessments on the geohazard consequences	Elvis Žic, Nevenka Ožanić
17:15-17:30	Overview of input data for quantitative risk analysis from the consequences of geohazard	Elvis Žic, Nevenka Ožanić
17:30-17:45	Visualization of average annual precipitation in Serbia for the period from 1946 to 2019	Miljan Jeremić, Milan Gocić

Friday, 24th September 2021		
University of Novi Sad, Faculty of Technical Sciences		
08:30-09:00	Participant's registration	
Keynotes		
09:00-09:20	Green Development and Water Resources Management	Prof. Elpida Kolokytha, Aristotle University of Thessaloniki
09:20-09:40	Climate-resilient regions through systemic solutions and innovations	Prof. Chrysi Laspidou, University of Thessaly (Greece), Vice-president of research & technology – Water Europe (Belgium)
09:40-10:00	Managing risks from digitalisation in the water sector	Prof. Harsha Ratnaweera, Norwegian University of Life Sciences
10:00-10:15	Break	
Third session **Session Chair**: Barbara Karleuša, University of Rijeka		
10:15-10:30	Perspectives of a climate crisis: higher risks from global to a small island environment	Luis Angel Espinosa, Maria Manuela Portela
10:30-10:45	Simulation of ungauged basins in climate change conditions	Charalampos Skoulirakis, Panagiotis Kotsalis
10:45-11:00	Nature based stormwater management solutions for housing area – Case study of roof garden implementation	Danijela Milanović, Borislava Blagojević, Ljiljana Vasilevska
11:00-11:15	Break	
11:15-11:30	Possibilities of application of HEC RAS two-dimensional models for prediction of bridge pier scour	Milena Ostojić, Ivana Ćipranić, Goran Sekulić

11:30-11:45	Natural water retention measures contribution to integrated transboundary Tisza River basin management-environmental and flood risk management objectives synergy	Branislava Matić, Marija Perović, Dragica Vulić
11:45-12:00	Master's thesis in the field of hydrotechnical engineering at the Faculty of civil engineering (University of Rijeka) – Good practice examples	Ivana Sušanj Čule, Barbara Karleuša, Bojana Horvat, Nevenka Ožanić
12:00-13:00	Break	
Young professionals in the water sector **Moderator**: Naomi Timmer, H2O People		
13:00-13:15	Young Water Professionals chapter in Serbia	Stevo Lavrnić, University of Bologna
13:15-13:30	IAHR Young Professionals Networks	Daniel Wildt, University of Natural Resources and Life Sciences, Vienna
13:30-13:45	European Junior Water Programme	Naomi Timmer, H2O People
13:45-14:00	UNESCO's Intergovernmental Hydrological Programme (IHP) Phase Nine (IHP IX): Priority Areas and the contribution of UNESCO Chairs	Skoulikaris Charalampos, Aristotle University of Thessaloniki
14:00-14:15	Break	
Partnerships for sustainable management of water resources **Moderator:** Zakhar Maletskyi, Norwegian University of Life Sciences		
14:15-14:30	Water Harmony – a global partnership for water education and research	Harsha Ratnaweera, Norwegian University of Life Sciences
14:30-14:45	SENVIBE – Strengthening educational capacities by building competences and cooperation in engineering subjects	Ivana Kovačić, University of Novi Sad
14:45-15:00	WaSo Africa – Promoting value of water through international cooperation	Ronald Semyalo, Makerere University, Uganda

15:00-15:15	Harmonising teaching and pedagogical approaches in water related graduate education between Asia and Europe	S. B. Weerakoon, University of Peradeniya, Sri Lanka
Concluding session		
15:15-15:45	Conclusions from the Symposium	Milan Gocić, University of Niš

ANNEX II – Attendance list

Name	Country	Participation
Milan Gocić	Serbia	In-person
Nebojša Vasić	Kosovo*	In-person
Mladen Milanović	Serbia	In-person
Vesna Mašulović	Serbia	In-person
Barbara Karleuša	Croatia	In-person
Bojana Horvat	Croatia	In-person
Michael Tritthart	Austria	In-person
Daniel Wildt	Austria	In-person
Susann Andersen	Norway	In-person
Zakhar Maletskyi	Norway	In-person
Harsha Ratnaweera	Norway	In-person
Naomi Timmer	The Netherlands	In-person
Ljiljana Jevremović	Serbia	In-person
Saša Nikolić	Serbia	In-person
Slaviša Trajković	Serbia	In-person
Ivana Kovačić	Serbia	In-person
Ivana Lukić	Serbia	In-person
Dejan Ubavin	Serbia	In-person
Skoulikaris Charalampos	Greece	In-person
Jelena Đokić	Kosovo*	In-person
Maja Petrović	Serbia	In-person
Jovana Topalić Marković	Serbia	In-person
Olivera Gavrilović	Serbia	In-person
Miodrag Živančev	Serbia	In-person
Nemanja Stanisavljević	Serbia	In-person
Bojan Batinić	Serbia	In-person
Bojana Tot	Serbia	In-person
Dušan Milovanović	Serbia	In-person
Sanja Kozarčić	Serbia	In-person
Borko Radivojević	Serbia	In-person
Maja Stanojević Gocić	Serbia	In-person
Srđan Kovačević	Serbia	In-person
Nebojša Arsić	Kosovo*	In-person
Slobodan Kolaković	Serbia	In-person
Milan Trivunić	Serbia	In-person
Željko Jakšić	Serbia	In-person
Goran Jeftenić	Serbia	In-person
Milan Marinković	Serbia	In-person
Tiana Milović	Serbia	In-person
Vladimir Živaljević	Serbia	In-person
Igor Peško	Serbia	In-person
Daria Ilić	Serbia	In-person
Borislava Blagojević	Serbia	In-person
Vladimir Bulicanu	Republic of Moldova	Online
Lidija Stojanović	Montenegro	Online

Milica Marković	Serbia	Online
Natalija Aleksić	Serbia	Online
Miša Stanojević	Serbia	Online
Milica Todorović	Serbia	Online
Rade Lučić	Serbia	Online
Marko Ćećez	Bosnia and Herzegovina	Online
Merima Salčin	Bosnia and Herzegovina	Online
Ivana Ćipranić	Montenegro	Online
Merima Šahinagić-Isović	Bosnia and Herzegovina	Online
Bojan Katić	Serbia	Online
Ammar Šarić	Bosnia and Herzegovina	Online
Zlatan Hamza	Bosnia and Herzegovina	Online
Mili Selimotić	Bosnia and Herzegovina	Online
Ievgenii Gerasimov	Ukraine	Online
Agnesa Porović-Hodžić	Bosnia and Herzegovina	Online
Pinchuk Oleg	Ukraine	Online
Vasileios Tyriakidis	Belgium	Online
Nikola Savić	Serbia	Online
Hata Milišić	Bosnia and Herzegovina	Online
Emina Hadžić	Bosnia and Herzegovina	Online
Ivana Mihajlović	Serbia	Online
Elvis Žic	Croatia	Online
Adnan Hodžić	Bosnia and Herzegovina	Online
Goran Sekulić	Montenegro	Online
Nevena Živančev	Serbia	Online
Panagiotis Prinos	Greece	Online
Mika Rašković	Montenegro	Online
Zorica Mirosavljević	Serbia	Online
Ivana Hadži Stošić	Serbia	Online
Tijana Adamov	Serbia	Online
Roman Smotraiev	Ukraine	Online
Slavka Bogdanova	Bulgaria	Online
Anita Radović	Montenegro	Online
Milena Ostojić	Montenegro	Online
Giuseppe Tito Aronica	Italy	Online
Петър Филков	Bulgaria	Online
Marija Perović	Serbia	Online
Branislava Matić	Serbia	Online
Damir Brđanović	The Netherlands	Online
Suvada Šuvalija	Bosnia and Herzegovina	Online
Mladenka Novaković	Serbia	Online
Эдуард Орай	Kazakhstan	Online
Anja Kalezić	Montenegro	Online
Milica Živković	Serbia	Online
Maja Sremački	Serbia	Online
Miljan Jeremić	Serbia	Online
Aleksandar Bogojević	Serbia	Online
Chrysi Laspidou	Greece	Online
Elpida-Kleanthi Kolokytha	Greece	Online
Sandra Perić	Serbia	Online

Kapileswar Mishra	India	Online
Ivana Sušanj Čule	Croatia	Online
Luis Angel Espinosa	Portugal	Online
Jovana Rašeta Bastić	Serbia	Online
S.B. Weerakoon	Sri Lanka	Online
Nataša Tomić	Serbia	Online
Stevo Lavrnić	Italy	Online
Ronald Semyalo	Uganda	Online
Qiran Li	China	Online