

Ergonomics and Human Factors in the Cyber Age. The Case of Ergonomics and Human Factors Regional Educational CEEPUS Network

Anca DRAGHICI¹, Gyula SZABO², Brigita GAJŠEK³, Beata MRUGALSKA⁴,
Tihomir DOVRAMADJIEV⁵, Aleksandar ZUNJIC⁶

Abstract – The Ergonomics and Human Factors Regional Educational CEEPUS Network (CIII-HU-1506-01-2021) was established and approved for funding in 2020 and still planned to be extended and developed. The network is the result of collaboration between nine universities with a key role in ergonomic education and research, promoting the profession of ergonomist (especially in industrial and logistics systems fields). Partners have agreed on providing support for master and doctoral programs, for joint scientific and didactic publications, at the level of European requirements and standards, but with a focus especially in the Danube region. The paper aims to present the achievements of the Ergonomics and Human Factors Regional Educational CEEPUS Network during the last two academic years (2020 – 2022) and the planned activities for the next period (2022 – 2023). The Network establishment and development is considered mature and could be a good practice example in the field of ergonomics collaborations by providing evidence of common activities and achievements that have conducted to the extension of the network and other project collaboration types of development.

Keywords Central European Exchange Program for University Studies (CEEPUS), network, ergonomics, human factors, collaborative work, mobility, education.

I. INTRODUCTION

“Central European Exchange Program for University Studies (CEEPUS) is the short form for Central European Exchange Program for University Studies and is a multilateral University exchange program in the extended Danube region based on an international Agreement. There are sixteen members

states who joint the current CEEPUS III agreement (Done at Budva, Montenegro, on March 25, 2010) now, each member state has a National CEEPUS Office” (CEEPUS, 2022).

The Central European Exchange Program for University Studies (CEEPUS) is a multilateral University exchange program in the EU Danube Region. It started with the agreement signed in 1995, being extended to 16 countries with active National CEEPUS Offices, in the present. As a prove of the intense activities developed, in the 2019 - 2020 academic year there were valid for mobilities 106 CEEPUS networks and later, in 2021-2022 more than 150 networks were active (CEEPUS, 2022).

Actually, “to the general objective to promote cooperation in the framework of the EU Strategy for the Danube Region (EUSDR), the CEEPUS III focus on joint PhD programs. Network activities on one hand range from semester long or short-term teacher and student mobility on Bachelor, Master and PhD level, short term excursions, intensive courses, and on the other hand consist of joint research, event organization and educational program development” (Szabo et al., 2021).

In this context, the paper aims to present the achievements of the Ergonomics and Human Factors Regional Educational CEEPUS Network (CIII-HU-1506-01-2021) during the last two academic years (2020 – 2022) and the planned activities for the next period (2022 – 2023). The Network establishment and development is considered mature and could be a good practice example in the field of ergonomics

¹ Politehnica University of Timisoara, Faculty of Management in Production and Transportation, Timisoara, Romania, anca.draghici@upt.ro

² Óbuda University Donát, Bánki Faculty of Mechanical and Safety Engineering, Budapest, Hungary, szabo.gyula@bgk.uni-obuda.hu

³ University of Maribor, Faculty of Logistics, Celje, Slovenia, brigita.gajsek@um.si

⁴ Poznan University of Technology, Faculty of Engineering Management, Poznan, Poland, beata.mrugalska@put.poznan.pl

⁵ Technical University of Varna, Faculty of Shipbuilding, Varna, Bulgaria, tihomir.dovramadjiev@gmail.com

⁶ University of Belgrade, Faculty of Mechanical Engineering, Beograd, Serbia, azunjic@mas.bg.ac.rs

collaborations by providing evidence of common activities and achievements that have conducted to the extension of the network and other project collaboration types of development. From the presentation there will be characterised partners involvement and activities in the CEEPUS Network. The CEEPUS Network (CIII-HU-1506-01-2021) evolution is presented in accordance with the paper's sections: (1) introduction; (2) description of the CEEPUS Network; (3) implemented and planned activities; (4) operational actions and partners contributions; (5) conclusions and final remarks.

II. DESCRIPTION OF THE CEEPUS NETWORK

The Ergonomics and Human Factors Regional Educational CEEPUS Network provides leading-edge competency in the human-oriented product, process, and organizational innovation (EHFRE, 2021). The aim of the network is to facilitate, encourage and support education, research, and professions in the field of ergonomics and the human factor, mainly through mobility, guidance, and joint support of doctoral programs (in accordance with existing legislation, rules, and regulations in each partner university), and in the long term it is aimed at creating a common doctoral training in the field (Szabo et al., 2021).

Partners in the network collaborate to create a formal academic structure for student exchange on bachelor, master, and doctoral levels, participate in each other's master and postgraduate programs and develop shared training contents, university courses, and joint doctoral programs in the long term. In addition, partners work together in various international ergonomics organizations (e.g., International Ergonomics Association and the Federation of European Ergonomics Societies) and report their research results to different international events and publications, thus increasing their work and collaboration visibility.



Fig. 1. The geographical spread of partners in the CEEPUS Network.

Furthermore, universities and related faculties partners also represent their national assessment boards at the Centre of Registration of European Ergonomists. The participating units have the usual shared activities like a regular CEEPUS network, as the Erasmus+ student (PhD) and teacher mobility, professional workshops, summer universities, research, and educational projects, and successful international doctorandus workshops.

The participating institutions in the network system have different educational profiles, but complementary; however, they share the fact that ergonomics is a priority in their education program, and they perform high-quality ergonomic research and education programs, and they employ prominent ergonomists. The composition of the network provides the institutional diversity needed to develop a program in this multi-disciplinary scientific domain. It is also common in the participating institutions that they are devoted to starting an ergonomics/human factors training based on the standard criteria of ergonomics, and they consider the Danube Region cooperation as a critical success factor. Our network started at the most challenging time, the epidemic's beginning. In the 2021/2022 academic year, we improved our mobility performance; however, despite continuous rescheduling, virtual mobilities and postponed mobility completion in October 2022, we could not meet the mobility goals. In addition to the regular operation of CEEPUS, we had to carry out continuous problem-solving, which shifted the priority from personal mobility to other network activities.

Although everyone has yet to meet everyone in person, our mobilities, the in-person network meeting in Varna, August 2021 and the personal meetings realized with CEEPUS and other funding contributed significantly to the operation of the network. Thanks to the three ERASMUS+ KA220-HED - Cooperation partnerships in higher education projects, we won enabled us to work together on focused collaboration every day. The CEEPUS and ERASMUS mobilities give us a solid foundation to operate the network. We believe the CEEPUS network is the origin of our collaborative success, and we want to use it to create even more possibilities. The network supports the national ergonomic associations. For example, the Romanian Ergonomic Association ErgoWork (Prof. Anca DRAGHICI, president) has recognized and rewarded Prof. Gyula SZABO and Prof. Aleksandar ZUNJIC as main promoters who contributed to the development of the ErgoWork association and the scientific event. In addition to the epidemic situation, it is difficult to mobilize students and staff for mobility due to a general lack of interest. CEEPUS mobilities are not economically attractive, as those who might want to travel can benefit more from, for example, Erasmus plus mobilities. Funding does not cover the costs of mobilities, so these trips would require additional resources and are only occasionally guaranteed. This year, we experienced that the success of mobility strongly depends on the attitude of the

national offices of each country. NCOs are very flexible and supportive occasionally.

The composition of the network will undergo a slight change in the next period. We extended the network in Bosnia-Herzegovina, with the implication of the Faculty of Mechanical Engineering of the University of Mostar. In addition, the Faculty of Manufacturing Technologies (located in Presov) of the

Technical University in Kosice, replace Constantine, the Philosopher University in Nitra from Slovakia. IMC University of Applied Sciences Krems continues to participate in our work as a network member rather than as a partner applicant. Details of the entities higher education units involved in the network are given in Table 1.

Table 1. The CEEPUS Network partners (for the 2023 – 2024 academic year)

Partner	Role	Description
<p>Óbuda University, Budapest, Hungary</p> <p>Donát Bánki Faculty of Mechanical and Safety Engineering</p>	Coordinator	<p>The faculty participates in several CEEPUS networks in mechanical engineering and mechatronics, and they intend to create similar mobility opportunities for their safety technology engineering students and teachers as well.</p> <p>The major education filed is on security engineering since the faculty staff support a bachelor and a master programme degree in this field and the existing doctoral school has been established in the field of safety science too. In the field of safety science, the faculty is actively involved in domestic professional life playing a vital role in the adaptation of international knowledge and practice, and actively participate in worldwide professional cooperation. The Ergonomics and Human Factors Regional Educational CEEPUS Network will extend our potential to fulfil our domestic role.</p> <p>Primary safety and security research topics in the faculty: IT safety and security organisational culture and behavioural safety human reliability; security technology; biometric identification; critical infrastructure protection; occupational safety and health; fire protection and industrial safety.</p>
<p>IMC University of Applied Sciences Krems, Austria</p>	Tender partner (Active partner for the 2022-2023 academic year)	<p>The university is a limited liability company. The shareholders consist of IMC Consulting GmbH (70%) and the city of Krems (30%). The university has many years of experience in business, health science and life science due to its activities in this sector. More than 3,000 students (approx. 70% women, 30% men) are currently enrolled in 32 full-time or part-time bachelor and master programmes in the fields of business, digitalisation and engineering, health sciences, and life sciences (50 % of the study programmes are offered in English). Due to the international orientation, the percentage of international students is 12%.</p> <p>The following research areas offer linkages to the CEEPUS Network and will be open for contribution: new world of work, Scan to VR, Train@train, consumer studies and innovation management, digital transformation and organisational development, tourism marketing and technology.</p>
<p>Technical University of Varna, Bulgaria</p> <p>Faculty of Shipbuilding</p>	Partner	<p>The strategy of TU-Varna in scientific research aims to establish the institution as an innovation and technology center. The following activities are realized:</p> <ul style="list-style-type: none"> • Stable connections with leading companies; • Creation of specialized laboratories; • Organization of business-incubators and High-Tech centers; • Creation of virtual labs at the university. <p>TU-Varna has been certificated for ISO 9001 quality management. It is a leading research center in “Advanced technologies in design, Software Technologies”, Internet and web-applications, “Smart technologies in telecommunications and computer networks”, “Samsung Innovation Lab”, “Mikrotik Lab” having high performance infrastructure and equipment in CAD-CAM, applied technologies in healthcare, Naval architecture and marine technology. TU-Varna collaborates closely with Municipality of Varna in projects dedicated to ‘science in the society’ and citizenship.</p> <p>They will seek to support internationalization through active dialogue with CEEPUS partners, exchange of information and promotion of ergonomic activities. TU-Varna will actively participate in the cultural exchange with partner countries through exchange at contact level.</p> <p>The mobility of teachers, doctoral students and students will be adjusted to the setting of specific goals and objectives to optimize the use of contacts, exchange of experience, knowledge and specific joint initiatives into ergonomics and science related fields. TU-Varna will strive to deepen the professional relations with the partners by creating opportunities for realization of joint international projects and programs. TU-Varna, together with the university partners, will support in the preparation of double diploma degree programs.</p> <p>The Bulgarian Ergonomics Society has been established in 2019 (by a group of teaching and research staff of TU-Varna) and is a member of the Federation of European Ergonomics Societies (FEES).</p>

<p>University of Zagreb, Croatia</p> <p>Faculty of Mechanical Engineering and Naval Architecture</p>	<p>Partner</p>	<p>The University of Zagreb (established 1669) is the oldest and biggest university in the Republic of Croatia. The Faculty of Mechanical Engineering and Naval Architecture is the oldest and the largest mechanical engineering school in the Republic of Croatia. The Faculty offers undergraduate, graduate and postgraduate programmes in three courses of study: mechanical engineering, naval architecture, aerospace engineering, and undergraduate and graduate programmes in mechatronics and robotics. Specializations and sub specializations in the mechanical engineering course are: Design (Medical Design, Product Design and Development, Mechanisms and Robots, IC Engines and Motor Vehicles); Process and Energy Engineering (Thermal Engineering, Process Engineering and Energy Engineering); Production Engineering (Production Automation, Machining Systems, Quality Assurance, Manufacture and Assembly, Welded Structures); Industrial Engineering and Management; Marine Engineering; Engineering Modelling and Computer Simulation; Computer Engineering (Intelligent Assembly Systems, Polymer Product Manufacture, Computer Modelling of Tools and Dies, Computer-Based System Management, Computer Integrated Product Development, Modern Machining Systems and Processes, Quality Management, Foundry) and Materials Engineering. To promote ergonomics, the Croatian Ergonomics Society was established in 1974 at the Faculty of Mechanical Engineering and Naval Architecture. The Society is a member of the Federation of European Ergonomics Societies (FEES) and International Ergonomics Association (IEA). Research topics in the field of ergonomics and human factors at the faculty are: biomechanics in ergonomics (determination and analyses of load on the human); development of assessment procedures; ergonomics in product and engineering design; improvement of human-machine-environment design; ergonomics in logistics (ergonomics in order-picking process). The PhD education is interested in: the development of the new shared training contents and courses; the development of PhD workshops; the co-supervision of PhD thesis; the participation in doctoral committees.</p>
<p>Poznan University of Technology, Poland</p> <p>Faculty of Engineering Management</p>	<p>Partner</p>	<p>The University offers lectures in English PhD School in English: cooperates with more than 100 universities all over the world; offers double diplomas; a member of Conference of European Schools for Advanced Engineering Education and Research, an organisation that brings together the best technical schools, a member of the Societe Europeenne pour la Formation des Ingenieurs, of the European University Association, of ADUEM (Alliance of Universities for Democracy) and the International Association of Universities. The Polish Ergonomics Society was established in 1977 and since then we managed to create its 14 sub-divisions located in the whole country. We belong to the Federation of European Ergonomics Societies (FEES) and International Ergonomics Association (IEA). In our country the National Assessment Board of European Ergonomists was established, and we are a member of the Centre for Registration of European Ergonomists. The Centre for Registration of European Ergonomists (CREE) confers the professional title "European Ergonomist" to designate qualified and experienced members of the profession. The quality of their professional practice and their education must be peer-reviewed, and they must adhere to a professional Code of Conduct. CREE certified people may use the letters Eur.Erg after their name. The role of the organization in the network: teach students and professors in ergonomics and human factor in theory and practice; will be responsible for the exchange students (B.Sc., M.Sc. and Ph.D.), exchange professors for teaching students and training in workshops; will be responsible for sharing laboratories with incoming students for working on Bachelor, M.Sc. or Ph.D. thesis; will be responsible for collaborating on comparative analysis of curriculums between CEEPUS network universities; will contribute in preparing teaching materials and their adoption in the redesign courses; will prepare with the partners a teaching book about ergonomics and human factor for students; will invite partners to prepare together papers for journals; will establish an exchange program between PUT and other partners to provide an attraction to students, bilateral knowledge transfer and industrial related student projects focused on new technologies</p>
<p>Politehnica University of Timisoara, Romania</p> <p>Faculty of Management in Production and Transportation</p>	<p>Partner</p>	<p>Politehnica University of Timisoara (UPT) is the biggest technical universities from the West part of Romania. The research and education in the field of Ergonomics and Human Factors are supported by 3 faculties: Faculty of Management in Production and Transportation (industrial ergonomics field, workplace management and occupational health and safety - bachelor, master and PhD. programmes), Faculty of Architecture and City Planning (ergo-design filed for different types of spaces - Bachelor level) and the Faculty of Mechanical Engineering (industrial ergonomics field, robotics - bachelor, master and PhD. programmes).</p>

		<p>In 2019, an initiative group from the Management Faculty has established the Romanian Society of Ergonomics and Workplace Management (ErgoWork) considering the maturity level reached in education and research in the local area and which is member of the Federation of European Ergonomics Societies (FEES). The same initiative group has carried out the successful national project for defining the qualification standard and for registering the profession of Ergonomist (code 226309) in the National Qualifications Register (level of studies - 4, higher studies). The common activities are meant to strengthen the ongoing collaboration in the field of Ergonomics and Human Factors to enrich:</p> <ul style="list-style-type: none"> • Education area: improve the curricula structure and context for the Bachelor and Master levels; to invite partners staff to present relevant and actual topics for the bachelor, master, and PhD students; to develop shared training contents, university courses; • Research area: to identify and develop common researches in specific topics (co-supervision of thesis as joint doctoral programs in the long term); to create a formal academic structure for student exchange on bachelor, master, and doctoral level (to develop a part of their research related to their thesis at one or more partner's organization/research laboratory); to invite experts from partners in the PhD. public defense (as reviewer deliver a report); to collaborate in develop and publish common articles to disseminate our common results (for conference proceedings and/or journals); to support the national conference (as invited participants to ErgoWork conference organized in Timisoara, Romania).
<p>University of Belgrade, Serbia</p> <p>Faculty of Mechanical Engineering</p>	Partner	<p>At the University of Belgrade, Faculty of Mechanical Engineering (UB-FME) European exchanges take place under the established Tempus and Socrates Programmes of the European Commission. As the Faculty fully implements the European Credit Transfer System (ECTS), qualifications gained at the Faculty of Mechanical Engineering are easily recognized and understood in other European countries, and vice versa.</p> <p>The Faculty can achieve multiple benefits, through: the opportunity for students to hear lectures on ergonomic topics that interest them, by the side of the international experts in this scientific area; possibility to exchange knowledge and experience between international ergonomics experts, related to the education of students in the area of ergonomics; possibility of participation of foreign international experts in mentoring work with PhD students; possibility of participation of foreign international experts in the commissions for the evaluation and defense of doctoral dissertations; possibility to use the laboratory facilities of the greater number of foreign laboratories; possibility of teamwork of students from different universities in finding new solutions of modern scientific and professional problems; possibility of realization of practical work of students (internships) abroad; improvement of the foreign language through the use of professional terms; the possibility of creating ergonomic study programs that will be common to a number of universities (colleges) in the countries participating in this project; creating a basis for ongoing cooperation of the entities participating in this project, which will result in continuous improvement of education in these countries especially in the field of ergonomics, as well as in the formation of quality experts who, upon completion of their studies will contribute to the development of economies in the countries where they work. Courses of ergonomics at the UB-FME are: Industrial ergonomics (BSc); Ergonomic designing (MSc); Man - machine system design (MSc); Man - machine interface (Ph.D.).</p>
<p>University of Maribor, Slovenia</p> <p>Faculty of Logistics (in Celje)</p>	Partner	<p>Slovenia is one of the few non-FEES (the Federation of European Ergonomics Societies) and non-IAE (International Ergonomics Association) countries with no trained ergonomists. Thus, the participation in the Network is of great importance in developing an educational program, transferring good practices and for common research activities.</p> <p>The Faculty could support the following activities: extend/spred ergonomics and develop teachers' competences in Slovenian existing education programs; measure and investigate the impact of the applied technology on health and productivity in manual working systems; study towards balanced productivity and ergonomics in the pursuit of lean intralogistics and production; improve the approaches of workplace design in the Industry 4.0 Era from productivity and ergonomics perspective.</p>
<p>Constantine, the Philosopher University in Nitra, Slovakia</p>	Partner (for the academic years 2021 – 2022 and 2022 - 2023)	<p>The Faculty of Natural Sciences at Constantine the Philosopher University in Nitra has accredited study programs on all three levels of study: bachelor, master, and PhD programmes. The main task of the Faculty is to provide university education and creative scientific research in the sphere of natural sciences, maths, and informatics. In the frame of Department of Informatics CPU in Nitra realizes education in bachelor's and master's grades in the following study programmes: Applied informatics and teaching academic subjects. The workplace disposes of up-to-date</p>

		<p>schoolrooms to provide sufficient hardware background for the realization of curricula. An ambition of the Department of Informatics is to offer to its student's wide-spectrum knowledge so that the graduate was able to find his/her place in the practice in the shortest possible time after the graduation. At the same time students have chances to acquire practical experience during the study by means of professional practice, which is planned both in master's and bachelor's studies. Department of Informatics has a fruitful and rich experience in cooperation with many companies, the research being divided into three directions:</p> <ol style="list-style-type: none"> 1. Knowledge Discovery and Data Analysis Research Group: Web mining, especially data preparation techniques and modelling of information systems stakeholders' behaviour depending on time, Text mining and natural language processing is focused on data pre-processing techniques in natural language processing research field, especially in the automated evaluation of machine translation, Learning analytics and educational data mining, modelling the VLE stakeholders' behaviour, content analysis, learning analytics architecture, self-regulated learning approach. 2. Modelling and Simulation in Specific Environments Research Group. This research field is focused on modelling and simulation of natural processes with emphasis on qualitative and quantitative analysis of static and dynamic systems and processes, design and development of new algorithms for solving the complex problem using neural networks, modelling parallel processes in operational systems, networks and educational processes using Petri nets. Internet of Things (IoT) – research in the field of sensors network, design and modeling of a sensory network using various modeling tools; the need to address the following challenges: communication, time synchronization, localization, durability: energy intensity, reliability and security; hardware and software implementation of the sensory network; analysis and evaluation of output data from sensor networks; implementing artificial intelligence in IoT environments (e.g., Fuzzy logic, neural networks, optimization approaches such as evolutionary algorithms, etc.); optimization tasks to reduce the energy consumption of the sensor network in the context of IoT. 3D printing is the next-generation engineering technology that is shaping designing and manufacturing fields for a better tomorrow. It is an efficient tool for engineers, designers, hobbyists, and researchers to give a distinct shape to their ideas. In the field of education of students, we introduce new technologies in the form of spatial 3D modelling and then we use the 3D printing to motivate students to better understand the issue. We use 3D printing in various subjects such as Cybernetics and Robotic systems. The contribution of the team is the erudition of the issue and the possibility of creating e-courses in the field of 3D modelling and 3D printing. We work with professional practice in the field of 3D printing like a Start-up company Pro Tec s.r.o. 3. Theory of Computer Science Education Research Group optimization of computer science education at primary and secondary schools with emphasis on learning programming languages, web-based education, adaptive and personalized learning. <p>The involvement in the CEEPUS Network is a great opportunity for extended the education and research activities with the ergonomics and human factors knowledge, approaches and perspective on man – machine - environment systems. The collaborations and mobilities in the CEEPUS Network should contributed to the teaching and research staff competence development.</p>
<p>Technical University in Kosice, Slovakia</p> <p>Faculty of Manufacturing Technologies (in Presov)</p>	<p>Partner (new partner)</p>	<p>Technical University in Košice is a public institution that provides education in the technical, economic, and artistic fields in all three levels of higher education, for domestic and foreign students. It was founded in 1952. Currently, the Technical University in Košice has 9 faculties. Each faculty offers accredited study programs for the bachelor, master and doctoral degrees of higher education. The faculty has 8 accredited study programs at the bachelor's level (1 Production management; 2 Monitoring and diagnostics of technical equipment; 3 Renewable energy sources; 4 Computer support of production technologies; 5 Industrial management; 6 Progressive technologies; 7 Smart technologies in industry; 8 Technologies of automobile production) and 8 accredited study programs in the master engineering degree (1 Intelligent technologies in industry; 2 Production management; 3 Monitoring and diagnostics of technical equipment; 4 Renewable energy sources; 5 Computer support of production technologies; 6 Industrial management; 7 Progressive technologies; 8 Technologies of automobile production), as well as 5 accredited study programs in the doctoral degree (1 Production technologies; 2</p>

		Computer support of production technologies; 3 Technical systems design; 4 Management of industrial production; 5 Process technology). The involvement in the CEEPUS Network is a great opportunity for education and research activities because Ergonomics and Human Factors knowledge are weak represented in education topics and research.
University of Mostar, Bosnia-Herzegovina Faculty of Mechanical Engineering in Presovo	Partner (new partner)	University of Mostar in numbers today: ten faculties, one academy, one hundred and forty study programmes, a thousand teachers and twelve thousand students. Today Faculty of Mechanical Engineering offers undergraduate, graduate and postgraduate programmes in three courses of study: mechanical engineering, computing and electrical engineering (having implemented the ECTS system). At this moment, there is no formal education in the field of “ergonomics” or “human factors” within the undergraduate, graduate and doctoral studies at higher education institutions in Bosnia and Herzegovina. There are courses in the field of “ergonomics” or “human factors” that are taught at undergraduate, graduate and doctoral curricula at our Faculty. The objectives of the CEEUS Network involvement are improvement of the curricula structures, development of training courses, conducting lectures in English, improvement of the student’s skills, support for professors in the field of ergonomics and strengthen the collaboration in the field of Ergonomics and Human Factors. The advantages of networking are availability of other universities research infrastructure, exchange of international knowledge in the field of Ergonomics and Human Factors and sharing and adoption a good practice through personal contact. The proposed networking will strengthen the collaboration to enrich the research and education in the field of Ergonomics and Human Factors.

III. IMPLEMENTED AND PLANNED ACTIVITIES

3.1. Activities in academic year 2020 - 2021

The network completed some mobilities before the academic year's official launch, however with countries locked down this option went out. At the time of the new network application, we just hope that we

can complete the CEEPUS founded mobilities in the remaining period of the year. Starting up a mobility network in the COVID-19 pandemic time is an extraordinary challenge. The secret of the survival of the Ergonomics and Human Factors Regional Educational CEEPUS Network is that this network is devoted to work together regardless of the circumstances. In Table 2 are centralized all the CEEPUS Network activities and their related outcomes with partners involvement.

Table 2. Activities in the CEEPUS Network in the 2020 - 2021 academic year

Partners involved	Type of activity, details description and outcomes
Conferences and workshops	
University of Timisoara, Romania (organizer) with participants from Hungary, Austria, Poland, Bulgaria	ErgoWork 2020 International Conference (18-20 June 2020), http://www.mpt.upt.ro/cercetare/conferinte/ergowork.html Publications: ▪ 34 papers published in Acta Technica Napocensis - Series: Applied Mathematics, Mechanics, and Engineering (Clarivate Analytics – Emerging Sources Citation Index – Indexed), vol. 64, Special Issue 1 (2021), https://atnamam.utcluj.ro/index.php/Acta ▪ 9 selected papers published in Human Systems Management journal (Clarivate Analytics – Emerging Sources Citation Index), https://www.iospress.nl/journal/human-systems-management/ , special issue: Draghici A. (Ed.), “Changes and challenges of human systems management during and after the pandemic”, vol. 39, no. 4.
Obuda University, Hungary with participants from Romania	1 st PhD and master student on-line workshop series (14 October 2020)
University of Maribor, Slovenia with participants from Romania	Logistics Summer Schools: “Designing future workplaces: Endless possibilities”, Celje, Slovenia (20-25 Sept. 2020)
Obuda University, Hungary with ALL partners involvement	Sessions of online training lessons on Ergonomics and Human Factors, together with: <ul style="list-style-type: none"> • Informative session for sharing the news from FEES (https://www.ergonomics-fees.eu/) and IEA (https://iea.cc/) • Promote the network (activities, opportunities and collaboration results) during the specific training or teaching classes with Bachelor and Master students
Obuda University, Hungary with participants from Austria, Romania, Poland, Bulgaria	“Ergonomics Redefined - Summer University on Ergonomics 34 th ” (7-9 July 2021), online with tracks in partners national languages, Ergonomics Redefined – Magyar Ergonómiai Társaság (ergonomiavilaga.hu)

Special Issues in prestigious journals	
Prof. Larisa IVASCU, PhD., Politehnica University of Timisoara, Romania	"Ergonomics and Sustainability" in Safety journal (Clarivate Analytics – Emerging Sources Citation Index), (4 papers accepted)
Prof. Dr. Beata MRUGALSKA, Poznan University of Technology, Poland	Special Issue "Human Factor in Lean Production" in Sustainability journal (Clarivate Analytics Indexed, IF = 2.576), (6 papers accepted to be published including debate on ergonomics in lean manufacturing)
Prof. Anca DRAGHICI, PhD., Politehnica University of Timisoara, Romania, and Prof. Nicoleta CARUTASU, University Politehnica of Bucharest, Romania	Special Issue "Synergies between Ergonomics and Sustainability for Work-Place Wellbeing—Solutions for Efficient and Effective Occupational Risk Management" in Sustainability journal (Clarivate Analytics Indexed, IF = 2.576) – launched in January 2021 - deadline 31 Nov 2021
Publications (articles, book chapters etc.)	
<p>[1] Zunjic A. (2020). The role of ergonomics in preventing the spread of the COVID-19 virus. <i>IETI Transaction on Ergonomics and Safety Journal</i>, 4(1), 1-4</p> <p>[2] Zunjic A. (2020). The influence of preventive maintenance of the city water supply network on the safe performance of citizens work activities in the conditions of the COVID-19 virus pandemic - case study. <i>IETI Transaction on Ergonomics and Safety Journal</i>, 4(1), 5-8.</p> <p>[3] Mohora I., Soim H., Capotescu S. (2020). Generations at work in the post-pandemic time. <i>IETI Transaction on Ergonomics and Safety Journal</i>, 4(1), 14-31.</p> <p>[4] Zunjic A., Stojkovic D., Cicevici S., Trifunovic A., Yue X. G. (2020). Influence of Covid-19 Virus on Stress Level in Population Groups With Different Status and Characteristics of Employment, <i>IETI Transaction on Ergonomics and Safety Journal</i>, 4(1), 32-38.</p> <p>[5] Neag, P. N., Ivascu, L., Mocan, A., & Draghici, A. (2020). Ergonomic intervention combined with an occupational and organizational psychology and sociology perspectives in production systems. In <i>MATEC Web of Conferences</i> (Vol. 305, p. 00031). EDP Sciences.</p> <p>[6] Draghici, A. (2020). Changes and challenges of human systems management during and after the pandemic. <i>Human Systems Management</i>, 39(4), 469-72 - Editorial to a Special Issue</p> <p>[7] Dufour, C., Draghici, A., Ivascu, L., & Sarfraz, M. (2020). Occupational health and safety division of responsibility: A conceptual model for the implementation of the OHSAS 18001: 2007 standard. <i>Human Systems Management</i>, 39(4), 1-41.</p> <p>[8] Mocan, A., & Draghici, A. (2020). A Proposed Ergonomics Maturity Level Framework and Assessment Tool. In <i>Innovation in Sustainable Management and Entrepreneurship: 2019 International Symposium in Management (SIM2019)</i> (p. 357). Springer Nature.</p> <p>[9] Neag, P. N., Ivascu, L., & Draghici, A. (2020). A debate on issues regarding the new ISO 45001: 2018 standard adoption. In <i>MATEC Web of Conferences</i> (Vol. 305, p. 00002). EDP Sciences.</p> <p>[10] Neag, P. N., Gaureanu, A., & Draghici, A. (2020). Characterizing Safety Leadership Based on the Seven Skills of Effective People Model. <i>Management (18544223)</i>, 15(3).</p> <p>[11] Bere-Semeredi I., Draghici A., Fistis G. (2020). Exploring the Training Needs for Climate Change and Sustainable Energy Consumption in the Case of Public Local Authorities. <i>Management (18544223)</i>, 15(2).</p> <p>[12] Boatca, M. E., Draghici, A., & Gaureanu, A. (2021). Home ergonomics—lessons learned. In <i>MATEC Web of Conferences</i> (Vol. 343, p. 11012). EDP Sciences.</p> <p>[13] Gajšek, B., Dukić, G., Butlewski, M., Opetuk, T., Cajner, H., & Kač, S. M. (2020). The impact of the applied technology on health and productivity in manual “picker-to-part” systems. <i>Work</i>, 65(3), 525-536.</p> <p>[14] Gajšek, B., Šinko, S., Kramberger, T., Butlewski, M., Özceylan, E., & Đukić, G. (2021). Towards Productive and Ergonomic Order Picking: Multi-Objective Modeling Approach. <i>Applied Sciences</i>, 11(9), 4179.</p> <p>[15] Gajšek, B., Dukic, G., Kovacic, M., & Brezocnik, M. (2021). A multi-objective genetic algorithms approach for modelling of order picking. <i>International Journal of Simulation Modelling</i>, 20(4), 719-729.</p> <p>[16] Gajšek, B., Stradovnik, S., & Hace, A. (2020). Sustainable Move towards Flexible, Robotic, Human-Involving Workplace. <i>Sustainability</i>, 12(16), 6590.</p> <p>[17] Dukić, G., Opetuk, T., & Gajšek, B. (2021). Space, Time and Ergonomic Assessment of Order Picking Using Horizontal Carousel. In <i>Proceedings of the 8th International Ergonomics Conference: ERGONOMICS 2020</i> (pp. 73-83). Springer International Publishing.</p> <p>[18] Mrugalska, B. (2020). Lean and ergonomics competencies: knowledge and applications. In <i>Human Systems Engineering and Design II: Proceedings of the 2nd International Conference on Human Systems Engineering and Design (IHSED2019): Future Trends and Applications, September 16-18, 2019, Universität der Bundeswehr München, Munich, Germany</i> (pp. 654-660). Springer International Publishing.</p> <p>[19] Ávila, S., Mrugalska, B., Wyrwicka, M. K., Souza, M., Ávila, J., Cayres, É., & Ávila, J. (2020). Cognitive and organizational criteria for workstation design. In <i>Advances in Manufacturing, Production Management and Process Control: Proceedings of the AHFE 2019 International Conference on Human Aspects of Advanced Manufacturing, and the AHFE International Conference on Advanced Production Management and Process Control, July 24-28, 2019, Washington DC, USA 10</i> (pp. 161-173). Springer International Publishing.</p>	

[20] Sudowski, M., & Mrugalska, B. (2020). Zapewnienie bezpieczeństwa transportu drogowego a manipulacje czasem pracy kierowców zawodowych. *Zeszyty Naukowe Politechniki Poznańskiej seria Organizacja i Zarządzanie*, 73, 245-251.

[21] Mrugalska, B., Dovramadjiev, T., Pavlova, D., Filchev, R., Stoeva, M., Bozhikova, V., & Dimova, R. (2021). Open-source systems and 3D computer design applicable in the dental medical engineering Industry 4.0–sustainable concept. *Procedia Manufacturing*, 54, 296-301.

[22] Szabo, G., Balogh, Z., Dovramadjiev, T., Draghici, A., Gajšek, b., lulić, T. J., ... & Zunjic, A. (2021). Introducing the ergonomics and human factors regional educational CEEPUS Network. *Acta Technica Napocensis-Series: Applied Mathematics, Mechanics, and Engineering*, 64(1-S1).

[23] Ivascu, I., Draghici, a., Gaureanu, A., & Bere Semeredi I. (2021). Rethinking the condition of ergonomics for sustainable development. *Acta Technica Napocensis-Series: Applied Mathematics, Mechanics, and Engineering*, 64(1-S1).

[24] Neag, P. N., Fatol, D., Ocakci, E., & Draghici, A. (2021). A Study On Safety Costs Impact. *Acta Technica Napocensis-Series: Applied Mathematics, Mechanics, and Engineering*, 64(1-S1).

[25] Balogh, Z., & Baláz, I. (2020). Optimizing of spatial activities monitoring using the Raspberry Pi and RFID system. In *Recent Trends in Intelligent Computing, Communication and Devices: Proceedings of ICCD 2018* (pp. 615-622). Springer Singapore.

[26] Pinter, R., Čisar, S. M., Balogh, Z., & Manojlović, H. (2020). Enhancing higher education student class attendance through gamification. *Acta Polytechnica Hungarica*, 17(2), 13-33.

[27] Francisti, J., Balogh, Z., Reichel, J., Magdin, M., Koprda, Š., & Molnár, G. (2020). Application experiences using IoT devices in education. *Applied Sciences*, 10(20), 7286.

[28] Radić, I., Rupnik, B., Šinko, S., Kramberger, T., & Gajšek, B. (2020). Redesign of the Workplace for Toolmakers towards Industry 4.0. In *Handbook of Research on Integrating Industry 4.0 in Business and Manufacturing* (pp. 492-511). IGI Global.

[29] Gajšek, B., & Herzog, N. V. (2020). Smart glasses in sustainable manual order picking systems. In *Sustainable Logistics and Production in Industry 4.0* (pp. 219-241). Springer, Cham.

[30] Draghici A., Carutasu N., Ivascu L. (2020). *Managementul riscurilor ocupationale*, Editura Politehnica Press, București (ediția 2-a) - a book in Romanian language

Table 3. Activities in the CEEPUS Network in the 2021 - 2022 academic year

Partners involved	Type of activity, details description and outcomes
Conferences and workshops	
University of Timisoara, Romania (organizer) with participants from Hungary, Slovenia, Poland, Bulgaria, Croatia, Serbia	ErgoWork 2022 International Conference (16-18 June 2020), http://www.mpt.upt.ro/cercetare/conferinte/ergowork.html Publications: <ul style="list-style-type: none"> ▪ 52 papers published in Acta Technica Napocensis - Series: Applied Mathematics, Mechanics, and Engineering (Clarivate Analytics – Emerging Sources Citation Index – Indexed), vol. 64, Special Issue 1 (2021), https://atnamam.utcluj.ro/index.php/Acta ▪ 12 selected papers published in Human Systems Management journal (Clarivate Analytics – Emerging Sources Citation Index), https://www.iospress.nl/journal/human-systems-management/, special issue: Draghici A. (Ed.), “Changes and challenges of human systems management during and after the pandemic”, vol. 39, no. 4.
University of Zagreb, Croatia (organizer) with participants from Romania, Hungary, Slovenia	9th International Ergonomics Conference - ERGONOMICS 2022. Event was organized as (Hybrid event) on December 7-10, 2022, in Zagreb, Croatia, https://www.h-e-d.hr/conferences.htm The post-conference Proceedings indexed in Scopus with full texts of all accepted and reviewed papers will be published by Springer titled "Proceedings of the 9th International Ergonomics Conference - ERGONOMICS 2022". Proceedings will be included is the series "Lecture Notes in Networks and Systems" with ISSN 2367-3370.
University of Maribor, Slovenia with participants from Serbia, Croatia	9th International Summer School on Logistics. The new logistics reality: Delivery with drones, 12 – 18 June 2022, http://summerschool.fl.um.si/
Obuda University, Hungary with ALL partners involvement	Sessions of online training and consultations on Ergonomics and Human Factors with: <ul style="list-style-type: none"> • Informative session for sharing the news from FEES (https://www.ergonomics-fees.eu/) and IEA (https://iea.cc/) • Promote the network (activities, opportunities and collaboration results) during the specific training or teaching classes with Bachelor and Master students
Publications (articles, book chapters etc.)	
[1]	Draghici, A., & Ivascu, L. (2022). <i>Sustainability and Innovation in Manufacturing Enterprises: Indicators, Models and Assessment for Industry 5.0</i> . Springer Singapore. (BOOK)
[2]	Gajšek, B., Draghici, A., Boatca, M. E., Gaureanu, A., & Robescu, D. (2022). Linking the use of ergonomics methods to workplace social sustainability: The Ovako working posture assessment system and rapid entire body assessment method. <i>Sustainability</i> , 14(7), 4301.

- [3] Choong, S. W. J., Ng, P. K., Yeo, B. C., Draghici, A., Gaureanu, A., Ng, Y. J., ... & Selvan, H. K. T. (2022). A Preliminary Study on Ergonomic Contribution to the Engineering Design Approach of a Wheel Loader Control Lever System. *Sustainability*, 14(1), 122.
- [4] Draghici, A., Dursun, S., Başol, O., Boatca, M. E., & Gaureanu, A. (2022). The Mediating Role of Safety Climate in the Relationship between Transformational Safety Leadership and Safe Behavior—The Case of Two Companies in Turkey and Romania. *Sustainability*, 14(14), 8464.
- [5] Corlan, R. V., Ionel, I., Boatca, M. E., Draghici, A., Balogh, R. M., & Bisorca, D. (2022, February). Indoor air quality research within a furniture factory. In *Journal of Physics: Conference Series* (Vol. 2212, No. 1, p. 012004). IOP Publishing.
- [6] Tleuken, A., Turkyilmaz, A., Sovetbek, M., Durdyev, S., Guney, M., Tokazhanov, G., ... Draghici A., Boatca M. & Karaca, F. (2022). Effects of the residential built environment on remote work productivity and satisfaction during COVID-19 lockdowns: An analysis of workers' perceptions. *Building and Environment*, 219, 109234.
- [7] Boatca, M. E., Draghici, A., & Robescu, D. (2022). Conception of ergonomic interventions and challenges during Covid-19 pandemic. *Safety and Health at Work*, 13, S195. (abstract publication)
- [8] Popescu, F., Păuncu, E. A., Drăgoi, I. I., Tomescu, M. C., Cristodor, P., Teodoru, A., ... & Draghici, A. (2022). Ergo@ Home Guideline—a Tool for Working from Home Using Information Technology, in Pandemic. *Safety and Health at Work*, 13, S196. . (abstract publication)
- [9] Boatca, M. E., Coroian, A., & Draghici, A. (2022). A new perspective on musculoskeletal disorders—emerging ergonomic risks in the European Union and Romania. In *MATEC Web of Conferences* (Vol. 354, p. 00017). EDP Sciences.
- [10] Draghici, A., Berger, M., Vaduva, R., Capotescu, S., & Kirchberger, C. (2022). UrbanLink15'. A Collaborative Research on Hybrid Work and 15-Minute Cities. *Journal for Facility Management*, 1(22).
- [11] Boatca, M. E., Draghici, A., & Gaureanu, A. (2021). Home ergonomics—lessons learned. In *MATEC Web of Conferences* (Vol. 343, p. 11012). EDP Sciences.
- [12] Draghici, A., & Ivascu, L. (2022). Green Manufacturing in the Context of Circular Economy. *Sustainability and Innovation in Manufacturing Enterprises: Indicators, Models and Assessment for Industry 5.0*, 1-15.
- [13] Mocan, A., Gaureanu, A., Szabó, G., & Mrugalska, B. (2022). Arguments for emerging technologies applications to improve manufacturing warehouse ergonomics. *Sustainability and Innovation in Manufacturing Enterprises: Indicators, Models and Assessment for Industry 5.0*, 115-164.
- [14] Draghici, A., Vaduva, R., Capotescu, S., Banaduc, G., & Robescu, D. (2022). Innovations for tackling post-pandemic related challenges - A collaborative research to discover new solutions for hybrid work in the context of 15-minute cities. *Acta Technica Napocensis-Series: Applied Mathematics, Mechanics, and Engineering*, 65(1S).
- [15] Jereb, B., Gajšek, B., Šipek, G., Kovše, Š., & Obrecht, M. (2021). Traffic density-related black carbon distribution: impact of wind in a basin town. *International Journal of Environmental Research and Public Health*, 18(12), 6490.
- [16] Dukić, G., Opetuk, T., Gajšek, B., & Lerher, T. (2021). Single-Tray VLM vs Dual-Tray VLM: Quantitative Throughput Comparison. *Tehnički glasnik*, 15(4), 498-503.
- [17] Mrugalska, B., Dovramadjiev, T., Pavlova, D., Filchev, R., Stoeva, M., Bozhikova, V., & Dimova, R. (2021). Open-source systems and 3D computer design applicable in the dental medical engineering Industry 4.0—sustainable concept. *Procedia Manufacturing*, 54, 296-301.
- [18] Pavlova, D., Filchev, R., & Dovramadjiev, T. (2022, March). Application of zirconium in dentistry for creating dental crowns. In *IOP Conference Series: Materials Science and Engineering* (Vol. 1235, No. 1, p. 012026). IOP Publishing.
- [19] Etienne, P., Zunjic, A., Ferreira, P., Michez, B., & Szabó, G. (2021, May). The European Machinery Directive: A Challenge for Manufacturers and Users. In *Proceedings of the 21st Congress of the International Ergonomics Association (IEA 2021) Volume III: Sector Based Ergonomics* (pp. 432-438). Cham: Springer International Publishing.
- [20] Adamović, P., Bočkaj, N., Lulić, T. J., & Kodvanj, J. (2022). Comparison of the conventional loading case on femur with Pauwels type III fracture with force reduction loading: A finite element study. *Pula*.
- [21] Grgić, I., Karakašić, M., Ivandić, Ž., & Jurčević Lulić, T. (2021). The Development of a Gracilis and Quadriceps Tendons Calibration Device for Uniaxial Tensile Tests. *Machines*, 9(12), 364.
- [22] Ahmed, J., Mrugalska, B., & Akkaya, B. (2022). Agile management and VUCA 2.0 (VUCA-RR) during Industry 4.0. In *Agile Management and VUCA-RR: Opportunities and Threats in Industry 4.0 towards Society 5.0* (pp. 13-26). Emerald Publishing Limited.
- [23] Niemir, M., & Mrugalska, B. (2022). Identifying the cognitive gap in the causes of product name ambiguity in e-commerce. *LogForum*, 18(3).
- [24] Mrugalska, B., & Dovramadjiev, T. A human factors perspective on safety culture. *Human Systems Management*, (Preprint), 1-6.
- [25] Dovramadjiev, T., & Mitkov, T. (2022). Investigation of the Luxury Yachts Condition and Their Maintenance. *International Journal of Engineering and Management Sciences*, 7(3), 95-105.
- [26] Dovramadjiev, T. A., Dimova, R., Pavlova, D., & Filchev, R. V. (2022). Applications of artificial intelligence in people & lifestyle based on education experience. *Biztonságtudományi Szemle*, 4(1. Ksz.), 35-48.
- [27] Dovramadjiev, T. (2022). Application of open-source software for creating three-dimensional dental models, mathematical calculating the mass properties of gold, zirconium and titanium and financial impact on the health care system. *IETI Transactions on Engineering Research and Practice*, 6(1), 15-28.

- [28] Dobreva, D., Dovramadjiev, T., Murzova, T., Tachev, M., Iliev, I., Cankova, K., ... & Staneva, G. (2022). Ergonomic and Design Research of the Auxiliary Furnishings in High School of Education in the City of Varna. *Human Interaction and Emerging Technologies (IHIET 2022)*, Vol. 68, 2022, 839–848 <https://doi.org/10.54941/ahfe1002813>
- [29] Filchev, R., Pavlova, D., Dimova, R., & Dovramadjiev, T. (2022). Healthcare System Sustainability by Application of Advanced Technologies in Telemedicine and eHealth. In *Human Interaction, Emerging Technologies and Future Systems V: Proceedings of the 5th International Virtual Conference on Human Interaction and Emerging Technologies, IHIET 2021, August 27-29, 2021 and the 6th IHIET: Future Systems (IHIET-FS 2021), October 28-30, 2021, France* (pp. 1011-1017). Springer International Publishing.
- [30] Dovramadjiev, T. (2021). Motion capture (MoCAP) and 3D computer design for ergonomics needs. *Methodology*, 11, 13.

TO BE Published:

- [1] Gajšek B., Cvahte Ojsteršek T. (2022). The Usefulness of Eye-Tracking Glasses in the Technological Upgrade of the Manual Workplace – an Ergonomic Aspect. *Proceedings of the 9th International Ergonomics Conference - ERGONOMICS 2022*
- [2] Neag P. N., Boatca M. E., Draghici A. (2022). Occupational Safety with Artificial Intelligence Application for Ergonomic Risk Assessment. *Proceedings of the 9th International Ergonomics Conference - ERGONOMICS 2022*
- [3] Neag P. N., Boatca M. E., Draghici A. (2022). Ergonomics for employees' satisfaction in lean manufacturing systems. *Proceedings of the 9th International Ergonomics Conference - ERGONOMICS 2022*
- [4] Farago F., Szabo G. (2022). Qualitative Assessment of the Occupational Health and Safety Knowledge Management Practices of Hungarian Companies. *Proceedings of the 9th International Ergonomics Conference - ERGONOMICS 2022*
- [5] Marko Čeredar, Tanja Jurčević Lulić, Jasna Leder Horina, Danijela Domljan: Pressure Distribution when Sitting on a Hard Surface without Cushioning - a Case Study. *Proceedings of the 9th International Ergonomics Conference - ERGONOMICS 2022*

3.2. Activities in academic year 2021 - 2022

During the pandemic crisis, mobilities within the CEEPUS Network were more sporadic, but joint research kept the same pace. The partners continued to work and communicate online, in hybrid manner and also face-to-face, which contributed to the generation of important research results, worthwhile for all. Table 2 presents, in a centralized way, the activities carried out within the CEEPUS Network, with significant details regarding the involvement of partners and the results obtained.

In the 2021/22 academic year the most important event of the CEEPUS Network was the ErgoWork 2022 International Conference on Ergonomics and Workplace Management, 16-18 June 2022, Timișoara, Romania, with more than 100 participants from universities, research centres and industry (the conference was organized hybrid).

Planned mobility actions: in the 2022/23 academic year, are meant to harmonise the content of educational curricula (up-date and introducing new topics) and research activities. The planned (approved and already accepted) mobilities between CEEPUS Network partners will provide the opportunities for:

- Guest lecturing for master and PhD groups of students (enrolled in different engineering programmes),
- Guest consultation and offering support for bachelor, master, and PhD programs. The focus will be on supporting common ergonomics and human factors research for PhD students:
- Joint research and project work for student teams coming from different universities/faculties partners in the Network;

- Short-term student mobility and student mobility for one semester.

The successful virtual PhD/MSC Workshop will be developed having the primary arena for continuous networking among students and faculty members of our network partners and beyond. An important aspect of the mobilities will be to facilitate the attendance of each other's conferences and scientific events, thus supporting the international committees and improving the scientific quality of the publications. The plan for 2022-2023 academic year is to proceed with the existing joint actions and start some small new scales ones.

IV. OPERATIONAL ACTIONS AND PARTNERS CONTRIBUTIONS

4.1. Actions and activities in 2022 - 2023

Operational actions planned to be developed in the academic year 2022-2023 are aligned with the already existing traditional events and actions and will benefit by the resources (financial, sponsorships, material, financial, time, human resources etc.) and capacities (for experimental and applicative studies, consulting contracts with industry etc.) of all partners.

Knowledge and innovation transfer between partners involved the CEEPUS Network will be a priority. Through the CEEPUS Network webpage (<https://sites.google.com/view/ceepusergohf/home>), partners could share creative content, news, publication, and mobility opportunities. These are provided after the regular virtual coordinator meetings; a coordinator meeting is planned to be organized on 20-21 October 2023 during the International Symposium on Management, organized by Politehnica University

of Timisoara, Romania, when an Ergo Workshop is planned to be developed (additional resources will be provided through other programmes and by sponsors).

In addition, the network management has been improved by implementing a shared calendar, thesis

topic/research inventory and file folder. Each partner in the CEEPUS Network implements mutually determined actions. Additional partnership contributions are presented in Tabel 4.

Table 4. Actions and activities in the CEEPUS Network in the 2022 - 2023 academic year

Partner	Type of action, activity with significant details description
Óbuda University, Budapest, Hungary	Involvement and support the event of the Hungarian Ergonomic Society who will organize an Ergonomic Summer University from 3 to 8 July 2023. Jointly, a coordinator meeting of the CEEPUS Network will be organized in connection with the event.
IMC University of Applied Sciences Krems, Austria	They want to establish student and teacher exchange with flexible short and long mobilities. Also, they plan to organize a summer school on topics like VR/AR
Technical University of Varna, Bulgaria	Will continue the support of the activities and action in the Network at the local and national level. See the opened official section of CEEPUS on the university web page: http://www2.tu-varna.bg/tu-varna/images/international/CEEPUS_TUV_2020.pdf
University of Zagreb, Croatia	On the 50th anniversary of the Croatian Ergonomics Society, in 2024 they plan to organize the international conference Ergonomics 2024 together with a PhD workshop and a round table with current topics in ergonomics.
Poznan University of Technology, Poland	They implement mutually determined actions and work on the joint program. In addition, they organize the International Seminar on Ergonomics, May 2022, Poznan, Poland – event related and with the support of the CEEPUS Network.
Politehnica University of Timisoara, Romania	They organize ErgoWork 2022 conference, as an event related to CEEPUS network. They prepare the ErgoWork workshop (5-7 papers and debate around the proposed research topics) during the International Symposium in Management 2023 (SIM 2023), 20-21 Oct. 2023, Timisoara, Romania. Prepare a proposal of an academic book of synthesis “Contemporary Ergonomics Issues” with contributions from all partners.
University of Belgrade, Serbia	They plan to support short term and long-term incoming and outgoing mobilities of ergonomic experts engaged in this project, to realise presentations to students on contemporary topics in ergonomics, to present novel approaches and methods in ergonomics. They agree on providing consultations directed to the improvement of the education process in ergonomics and participation in the creation of standard courses in the field of ergonomics that will be applicable in part or in all of the countries that participate in this project. The university is most interested in receiving and sending ergonomic experts that will contribute through consultation to the realisation of high-quality PhD theses of students.
University of Maribor, Faculty of Logistics in Celje, Slovenia	They are still extremely interested in foreign teaching practices and practice with membership in European and global ergonomics societies. They would like to strengthen connections within Slovenia, among professors from different institutions, to be able to discover interested Master and PhD students, who would be motivated to participate in CEEPUS Network. To get closer to these goals, the establishment of study programs in English helps a lot; these will be fully implemented in the next three years, which means that the faculty will become suitable for student exchanges for the entire semester. Currently, only short-term mobility and participation in co-mentorships for diploma theses at all levels of Bologna studies are feasible. Slovenian partners would like to continue with recognition of the potential of incorporation of ergonomics topics in the logistics curriculum that would give them a starting point to engage master and PhD students in enriched study programs or to send them abroad to study ergonomics in the logistics research domain. They plan to invite professors and students from CEEPUS Network to work intensive event in study year 2023/24. Title will be announced later in spring 2023. Thematic will encompass ergonomics and human factors
University of Mostar, Bosnia-Herzegovina Faculty of Manufacturing Technologies in Presov	They would like to support the CEEPUS network mainly through students, teachers, and scientific researchers mobilities, during which there would be discussions and mutual sharing of experiences in the educational field with the aim of bringing education closer to the standards of European universities. They consider activities focused on ergonomics and human factors, or the needs of people with special health needs, to be important elements of actual educational process, therefore they appreciate the opportunity to participate in joint meetings in the framework of mobilities, which will create the basis for the possibility of developing further cooperation in the framework of research and the preparation of joint projects

The CEEPUS network activities and results are constantly promoted online and face-to-face in our institutions to prospective students directly, and we had presentations to students as part of mobilities. We prompted the network at the ErgoWork international conferences series, on the Federation of European Ergonomics Societies (FEES) website, and in the

FEES' newsletters. Partners are promoting the CEEPUS network constantly in their university community (with the support of the teaching and research staff involved). In addition, all partners in the Network agree on supporting:

- The ErgoWork international conference organize in partnership by Politehnica

University of Timisoara, Romania and the ErgoWork association in Romania;

- The Ergonomics 2022 international conference organized by University of Zagreb, Croatia in partnership with different national associations of ergonomics.

4.2. Selection Criteria for Mobilities

Student mobility - Partners recruit students interested in studying abroad. The sending and receiving partners discuss possible mobility objectives and evaluate study opportunities. At the partner meeting, there have been agreed to assess candidates based on their language skills, appropriateness of the topic, and study opportunities. Students are selected for mobility by consensus. Priority is given to PhD students and joint research and project work.

Short Term Student mobility - Applicants are asked to prepare a ten-minute motivation video. After watching videos, the coordinators make the selections with consensus; language skills, topic and relevance to the network are important criteria for selection. Priority is given to PhD students for joint research and project work and mobilities to intensive courses.

Teacher mobility - Teaching and research staff will be assessed for mobility applications according to the need of the host institutions. Decision factors are the expected interest in the lecture topic, the number of students working on related research and the applicant's scientific performance and language skills. Priority is given to activities at the postgraduate level.

Coordination - Regular one-hour meetings are scheduled by zoom with all CEEPUS Network partners first Wednesday every month at 6 PM Budapest time; ad-hoc meetings are organized on-demand for urgent matters with the involved parties and the coordinator. The meeting minutes and other documents are stored in a shared cloud directory (e.g., materials discussed at the monthly coordinator meetings, invitations as call for papers, plans and templates for the publications etc.).

The Network management has been improved by implementing: a shared calendar, thesis topic/research inventory and file folder.

Recognition - The basis of the mutual recognition is the International Ergonomics Association (IEA) endorsed minimum criteria of the Registration of European Ergonomists (EurErg) which defines the educational requirements in the ETCS system. With some partners, we are using this system for a decade together, and we are very experienced to level various ergonomics courses. All the partners in the network know well the EurErg system, and we will use it in the network. Previous Erasmus PhD mobilities showed that we could work together to mentor PhD researchers.

Special Merit - The CEEPUS Network supports the ongoing activities at the Federation of European Ergonomics Societies (FEES) and in the Centre of Registration of European Ergonomists (CREE).

“The areas of knowledge (A – K) in accordance with CREE guidelines require evidence of primary education across the following Areas of Knowledge:

- A. Principles of Ergonomics;
- B. Populations and General Human Characteristics;
- C. Design of technical systems;
- D. Research, evaluation, and investigative techniques;
- E. Professional issues;
- F. Ergonomics: Activity and Work Analysis;
- G. Ergonomic Interventions;
- H. Ergonomics: physiological and physical aspects;
- I. Ergonomics: psychological and cognitive aspects;
- J. Ergonomics: social and organisational aspects;
- K. Project work.

A minimum of 2 ECTS required for each of these Areas of Knowledge. It is necessary to have covered most of the recommended topics within an Area of Knowledge but not necessarily all of them. Building on this primary education, an ergonomist must show studies at an advanced level of knowledge in ergonomics, with a minimum total of 60 ECTS. An advanced level of knowledge can be achieved within cognitive, physical, or organisational ergonomics or in a combination of these. The supervised project work (K) must have between and 20 ECTS| (CREE, 2022).

In the CEEPUS Network some of the members have already announced their intention to follow the CREE procedure for being recognized as European Ergonomists certified.

Finally, it is important to mention that the added value on FEES side is to bring together ergonomists / human factor professionals and to encourage the creation of national ergonomics societies in the Balkan region. On the CREE side, the expected outcome is to extend the certification system and improve the mutual recognition of the ergonomics and human factors profession. The CEEPUS Network is promoted in these organisations using the activities developed and results achieved; most of the The CEEPUS Network activities, actions and events are supported by these organisations.

4.3. Extension of the CEEPUS Network Research Activities by the Development of Other Projects

Network members submitted a no-win proposal: H2020-SC1-DTH-2018-2020 (Digital transformation in Health and Care) Proposal number: 101017556 Proposal acronym: alw_EDI.

Thanks to the CEEPUS Network collaborations, there were submitted five project proposals in the framework of Erasmus+, Key Action 220, Higher Education - Cooperation partnerships, some of the projects were approved for being financed.

- ID KA220-HED-0C8D3623 "Life in the AI Era" a two-year project aiming to explore the relationship between Artificial Intelligence (AI) and everyday life, compile a toolbox, and develop e-learning

educational material for students in higher education (<https://lifeintheaiera.eu/>).

- ID KA220-HED-0D601A76 "ErgoDesign" is a successful three-year project, aiming to systematize ergonomics and 3D printing knowledge for healthcare purposes, gather available tools, and develop e-learning educational material (<http://ergodesigner.eu/>).

The project, "*SLog4.0 - Sustainable Logistics4.0: Digital and Green Skills for Boosting Innovation and Sustainability of the Logistics Sector*", was also approved to be financed supported by EU funds and started on 1st September 2022. The Slovene team work together with Politehnika Poznanska from Poland. (<https://slog4.put.poznan.pl/>).

Another successful project developed and implemented by some partners of the CEEPUS Network is "INNO3D+ - 3D Printing Support Service for Innovative Citizens" project (contract no. 2019-1-IE203-000693INNO3D, <https://www.inno3d.eu/>). Politehnica University of Timisoara, Romania and Constantine, the Philosopher University in Nitra, Slovakia were involved in this project which aims to design, to improve and diversify the services offered to users of university (through their libraries) by offering library users key skills and the opportunity to develop 3D printing competencies. The project has been dedicated to the development of a complex training program possible to be implemented with the support of the created makerspaces that provide 3D printing services. Human-machine/3D printers' interaction was one of the core topics, training materials being focused on maintenance operations.

In the nearest future, CEEPUS Network partners plan to prepare a research project proposal in the field of ergonomics and logistics to apply for a bilateral research project in the framework of the WEAVE project call.

In addition, Politehnica University of Timisoara, Romania, Faculty of Management in Production and Transportation joined another CEEPUS network: RO-0202-16-2223 with the title: "*Implementation and utilization of e-learning systems in the production engineering network study area*".

Partners CEEPUS network are committed to using modern teaching methods. The use of digital technologies raises both professional content and educational methodological issues for us, in which we are taking a pioneering role. Partners are active in the use of e-learning. Before and most during the pandemic, e-learning materials have been developed (in the field of ergonomics, human factors, occupational health, and safety) and most of the teaching staff of the Network has participated in local and international curriculum development programs. The most important e-learning courses that has been supported and followed by most of the partners is "TRAIN4HCWORK" (contract no. 2018-1-ES01-KA203-050887, <http://www.train4work.eu/>). During the project implementation has been created an online

course focused on the design of human-centred workplaces that will contribute to address actual challenges in industry.

The CEEPUS Network members also take advantage of the ERASMUS+ mobility opportunity to implement student and teacher study trips. Thus, partners established bilateral agreements in scientific fields close to the CEEPUS Network. The advantage of CEEPUS Network mobilities is the members' closer cooperation and the implementation's flexibility. The ERASMUS+ program, on the other hand, offers more favourable financial conditions.

V. CONCLUSIONS AND FINAL REMARKS

The Ergonomics and Human Factors Regional Educational CEEPUS Network mission is to contribute to the competitiveness of the Danube Region by providing e competency on the human-oriented product, process, and organizational innovation. The goal of the Ergonomics and Human Factors Regional Educational CEEPUS Network is to strengthen the ongoing collaboration of the participating institutions, to create a formal academic structure for student exchange on bachelor, master, and doctoral level, to participate in each other's master and doctoral programs, and to develop shared training contents, university courses, and joint doctoral programs in the long term. In addition, the common research and publications will better valorise the existing infrastructure and knowledge of all partners creating valuable added value to the ergonomics and human factors field of science.

Although the pandemic crisis affected mobilities and collaboration in the CEEPUS network, it turned out that all partners were involved in activities and actions at the level of the period 2020 - 2022. This new type of collaboration (online or hybrid) led to the following conclusions and remarks.

Intensifying the use of new digital technologies in ergonomics educational activity, as well as in the case of research activity. Multimedia technologies are increasingly present in the relationship between network partners. Thus, the mobility periods were more intensively used for collaboration between specialists, between researchers of all categories and by students.

Two international scientific events have become traditional: the ErgoWork conference organized by Politehnica University of Timisoara, Romania and the ERGONOMICS conference organized by Zagreb University, both of which are biannual events (organized in 2020, 2022 and most likely in 2024) that polarize not only researchers from the CEEPUS network but and other specialists affiliated to different national ergonomics societies / associations. FEES supports the two conferences accordingly. The research results were fruitful through joint publications, of high scientific quality. Thus, the network became visible at the news of some prestigious

communities of specialists, at the level of FEES and IEA. Although apparently the partners of the CEEPUS network have different and divergent competences, within the joint activities and publications, a convergence and a complementarity of these competences can be noted. Diversity can only be integrated in an interdisciplinary approach, as it happens in the case of ergonomic education and research.

The obstacles, barriers that induce problems in the mobilities development were:

- The Covid-19 pandemic restrictions (from 2020 till April 2022);
- The situation in the Eastern part of Europe generated by the war in Ukraine (from February 2022 till now) and that will low the frequency of the mobilities in the neighbouring countries (e.g., Poland);
- The CEEPUS financial support, and most providing substantial amount of the CEEPUS grant for PhD students' research. It seems that most of the students

are less attract by this type of mobilities due to their low rate;

- The doctoral program of three/four years requires a regular stay in the host countries of the PhD students and thus, they will not have time for mobility.

REFERENCES

- [1] CEEPUS (2022). Central European Exchange Program for University Studies. Retrieved from: <https://www.ceepus.info/content/about> (Access on 13-Sept-2022)
- [2] CREE (2022), Centre of Registration of European Ergonomist, Requirements for European Ergonomists (Eur.Ergs). <https://eurerg.eu/requirements> (Access on 13-Sept.-2022).
- [3] EHFRE (2021). The Ergonomics and Human Factors Regional Educational CEEPUS Network, CIII-HU-1506-01-2021. <https://sites.google.com/view/ceepusergohf/home?authuser=0> (Access 12-Sept.-2022).
- [4] Szabó, G., Balogh, Z., Dovramadjiev, T., Draghici, A., Gajšek, B., ... & Zunjic, A. (2021). Introducing The Ergonomics and Human Factors Regional Educational CEEPUS Network. *Acta Technica Napocensis - Series: Applied Mathematics, Mechanics, and Engineering*, 64(1-S1).