



### **EWG-ORSDCE**

### NEWSLETTER OF EWG ORSDCE DECEMBER 2022

ORSDCE - The OR in Sustainable Development and Civil Engineering Working Group of EURO https://www.euro-online.org/websites/orsdce/

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### Words of chairman

Dear Members of EWG-ORSDCE, dear Friends,

This issue of newsletter presents this year news, achievements and forthcoming events.

The active members of EWG-ORSDCE published several successful Special Issues in different Clarivate Analytics Web of Science journals and currently, some more issues open for submissions in journals related to the research field of our Working Group presented in this newsletter.

Please visit EWG-ORSDCE website <u>https://www.euro-online.org/websites/orsdce/</u> register or update your personal information on members' portal.

As usual, we invite you to submit the papers to the journals published by the active members of EWG-ORSDCE: Technological and Economic Development of Economy, Journal of Civil Engineering and Management, Journal of Business Economics and Management, International Journal of Strategic Property Management, and Engineering Structures and Technologies. Congratulations on all your achievements and best wishes for future activities.

With my best wishes, yours sincerely, Edmundas Kazimieras Zavadskas, Chair of EWG-ORSDCE

### Forthcoming events





July 10-14 · SANTIAGO, CHILE

### **Collaborating Institutions**



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### IFORS July 10 to 14, 2023. Santiago, Chile

The International Federation of Operational Research Societies (IFORS) is a 60-year old organization which is currently composed of 50 national societies. Its beginnings date from 1955, when the vice-president of the Operations Research Society of America (ORSA) sent a proposal for an international conference to the secretary of the UK society, the Operational Research Society (ORS). The French Society, SOFRO, was added as a sponsoring society to what would be the first in a line of triennial conferences. This was the 1957 Oxford Conference, described by Maurice Kirby as the fifth of the seven defining moments in OR history (Cummins, 1998).

Researchers, academics, practitioners, and students in any branch of operational research, mathematical modelling, data analytics, or economic analysis are invited to submit abstracts or organize sessions..

Clusters and areas:

- Agricultural Innovations and OR
- Agrifood Supply Chains

- Analytics and Data Science
- Applied Probability and Statistics

### EURO

- Combinatorial Optimization
- Data Envelopment Analysis and its Applications
- Data Science Meets Optimization
- Energy
- Game Theory and Operations Management
- Location, Network Design, and Routing
- Logistics
- Metaheuristics
- Military, Defense, and International Security
- Multilevel and Stochastic Optimization Methods
- Multiple Criteria Decision Analysis
- OR and Ethics
- OR for Development and Developing Countries
- Production Management, Supply Chain Management, and Location

- Sustainability Analytics and Modeling
- Scheduling in Logistics
- Packing and Routing
- OR in Sports
- OR and Food Sourcing and Distribution
- Optimization of Power Systems
- Multi-Objective Optimization: Theory, Algorithms, and Applications
- Mobility and Transportation Systems
- Metaheuristics for Hyperparameter Optimization
- Maritime Logistics
- Knowledge and Technology Analytics in Organizations
- Continuous Optimization
- Discrete Optimization
- Education in OR
- Game Theory, Market Design, and Mathematical Economics
- Healthcare Management

• Urban Transportation

Researchers who wish to organize a session or contribute with an abstract within a cluster should contact one of the chairs of the corresponding cluster.

Abstracts must be written in English and must have a maximum of 2500 characters. No participant can present more than one paper at the conference.

The person submitting the abstract must be the one presenting.

All accepted and presented abstracts will be published online as a monograph with ISBN / DOI identifier numbers.

### Key dates & deadlines

Abstract submission opens: Abstract Submission Deadline: Notification of Abstract Acceptance:	March 1st, 2023 March 15th, 2023 TBC
Registration:	
Registration: Early Registration Deadline: Author Registration Deadline:	April 25th, 2023 May 10th, 2023
Registration information	

**Regular Registration Fees:** 

Early Registration

EURO

US\$ 680

Student/Retired Registration Fees:

Early Registration	US\$ 170
Late Registration	US\$ 210
Accompanying Person	US\$ 250

The registration system will be available by March 1st, 2023. Online registration will be processed through the EURO system and website.

### Venue

### IFORS 2023 will take place in two main locations



The Extension Center in the Central Campus of Pontificia Universidad Católica de Chile (PUC).



The Faculty of Economics and Business in the Campus Andrés Bello of the University of Chile



Address : Instituto Sistemas Complejos de Ingeniería, República 695, Santiago Centro, Chile. Phone: +56 2 2689 4429 | +56 2 2689 4403 E-mail : info@ifors2023.com, registration@ifors2023.com Web Page : www.ifors2023.com



Welcome Organising Committee Venue Contact







33rd European Conference on Operational Research 30th June – 3rd July 2024 Technical University of Denmark (DTU), Copenhagen, Denmark

https://euro2024cph.dk/

### Venue

The Technical University of Denmark - often simply referred to as DTU - was founded in 1829 at the initiative of Hans Christian Ørsted (the father of electromagnetism) to develop and create value using the natural sciences and the technical sciences to benefit society.

Today, DTU is ranked among Europe's leading engineering institutions and recognized internationally as a leading university in the areas of the technical and natural sciences, renowned for its business-oriented approach, high level of international research, its sought-after graduates, and its focus on sustainability.

The conference venue is in DTU Lyngby campus in the northern part of Copenhagen, close to the sea and the forest of Dyrehaven. The campus is connected to the city of Lyngby and Copenhagen via bus and suburban train lines. We have a modern campus with upgraded learning facilities.

### Contact

EURO 2024 Conference Secretariat: DIS Congress Service Lautruphøj 1-3 2750 Ballerup Denmark

e: <u>euro2024cph@discongress.com</u> p: +45 4492 4492

Please contact the conference secretariat regarding any queries you may have in relation to the congress registration or general information.



The 18th Colloquium "New Trends in Construction Management" and a meeting of a European working group The 8th Meeting of Euro Working Group Operational Research in Sustainable Development and Civil Engineering



#### Edyta Plebankiewicz

On 19 - 20 May 2022, Kraków hosted an event including an international conference entitled The 18th Colloquium "New Trends in Construction Management", combined with a meeting of a European working group entitled The 8th Meeting Of Euro Working Group Operational Research In Sustainable Development And Civil Engineering. For the first time ever, the organisation of this event was undertaken by the Department of Construction Management (L-7) of the Faculty of Civil Engineering at the Cracow University of Technology (PK). The conference took the form of a hybrid meeting, enabling 40 people to attend, including: 30 people in a land-based format and 10 in an online teleconference format. The conference hosted researchers from Lithuania (Vilnius Gediminas Technical University), Germany (Leipzig University of Applied Sciences), India (Indian Institute of Technology Guwahati), USA (Eastern Michigan University) and Poland (Krakow University of Technology, Poznan University of Technology and AGH University of Science and Technology in Krakow). The stationary part of the conference was in the building of the Małopolska Laboratory of Energy-Efficient Construction.

During the plenary session, welcome words were given by the Dean of the Faculty of Civil Engineering at PK, Professor Andrzej Szarata, the Coordinator of the EWG-ORSCDE working group, Professor Audrius Banaitis from Lithuania, the Director of MLBE, Professor Marcin Furtak, and the Head of the Department of Construction Management, Professor Edyta Plebankiewicz, who also acted as the Chair of the Scientific Committee of the conference. Then, Professor Oleg Kaplinski from the Poznan University of Technology spoke about the evolution of international colloquia and the European working group working on sustainable development in civil engineering. In addition, representatives of Vilnius Gediminas Technical University from Lithuania had their presentations. Assoc. Prof. Tatjana Vilutienė pointed out the current activities of the EWG-ORSCDE working group, and Professor Zenonas Turskis gave a paper on the development of multi-criteria methods in solving complex decision-making problems using the TOPSIS method as an example. The plenary session ended with the nomination of Professor Edmundas Kazimieras Zavadskas from Lithuania as Honorary President of the EWG-ORSCDE working group. Afterwards, the participants of the event were shown around the Laboratory building by the Director of MLBE - Professor Marcin Furtak, who gave a lecture on the activities of MLBE and the scope of research that can be carried out with the help of the apparatus permanently installed in the building as well as that which is the Laboratory's equipment.



The first day of the session included several presentations on issues of construction management in its broadest sense. Six papers were heard in session one. Session two was a poster session in which 14 posters were presented.

The outcome of the meeting is a monograph consisting of 12 chapters, published by the Cracow University of Technology Publishing House (to be released in print in January 2023). The subject matter of the monograph concerns the use of multi-criteria approaches in sustainable development and civil engineering. Multi-criteria methods are used, among others, in structural safety problems, comparison of alternative building locations, selection of rational technological variants of passive energy efficiency measures and selection of the installation method of masonry facades. In addition to well-known methods such as DEMATEL, WASPAS and SAW, the authors also present their own tools, such as multi-criteria analysis based on fuzzy numbers. Topics covered include structural safety, life-cycle costing, risk assessment and the most common reasons for decisions to demolish or redevelop brownfield sites. Two papers analyse the problems of defects in residential buildings, both in Lithuania and Poland. The authors of the papers also analyse the issue of construction contracts.



In addition to the time devoted to presentations, conference participants taking part in the stationary format had the opportunity to enjoy time together at a collegiate dinner, which concluded the first day of the event. On the second day of the conference, a tour of the most important sites in the Old Town took place, after which the event was summarised, and participants were bid farewell.

### The website for EWG ORSDCE

The website of EURO Working Group on Sustainable Development and Civil Engineering can be accessed using this link:

https://www.euro-online.org/websites/orsdce/

If you are a member of the working group, but your name is not yet on the list of members, please register here: <u>https://www.euro-online.org/websites/orsdce/register/</u>

### Register

Create your account on Euro Online MultiSite					
Username:					
(Must be at least 4 characters, letters and numbers only.)					
Email Address:					
We send your registration email to this address. (Double-check your email address before continuing.)					
First Name:					
(Must be input.)					
Last Name:					
(Must be input.)					
Institution:					
Country:					
<b>T</b>					
Interests:					
Personal website:					
The following information are for internal use and will not be shared.					
-					
City					
Address					
Zincode					
Confirm you are human:					
I'm not a robot					
Signup					
0F					

To become a member of EURO Working group on Sustainable Development and Civil Engineering, please register and send the filled form to Coordinator. The form you can upload from the website.

### Journal Special Issues aimed at optimization of processes in engineering and management

### Edmundas Kazimieras Zavadskas, Jurgita Antuchevičienė, Tatjana Vilutienė, Audrius Banaitis

We are proud to announce that active members of EWG-ORSDCE published many successful Special Issues in different Clarivate Analytics Web of Science journals and currently some more issues are open for submissions in journals related to the research field of our Working Group.

### **Special Issues published in 2022:**



### energies

• Special Issue "*Construction Project Management 2021*" in Journal "*Energies*" (closed on 20 March 2022)

*Guest Editors: Nerija Banaitiene, Audrius Banaitis, Chunlu Liu* <u>https://www.mdpi.com/journal/energies/special issues/construction project management 20</u> <u>21</u>



• Special Issue "*Architecture: Integration of Art and Engineering*" in Journal "*Buildings*" (closed on 30 June 2022)

*Guest Editors: Oleg Kapliński, Agata Bonenberg, Wojciech Bonenberg, Marco Lucchini* <u>https://www.mdpi.com/journal/buildings/special issues/Artl Engineering</u>



• Special Issue "*Big data-driven large-scale group decision making under uncertainty* (*BiGDM-U*)" in Journal "Applied Intelligence"

*Guest Editors: Abbas Mardani, Edmundas Kazimieras Zavadskas, Hamido Fujita, Mario Köppen* <u>https://link.springer.com/journal/10489/topicalCollection/AC\_d62ffe5b87ea9f4fbc01959b0f4</u> <u>477cf</u>

# sustainability

• Special Issue "*Design and Construction of Civil Engineering Structures Appropriate for Sustainable Development*" in Journal *"Sustainability"* (closed on 31 May 2022)

Guest Editors: Agnieszka Leśniak, Krzysztof Zima https://www.mdpi.com/journal/sustainability/special issues/CivilEngineering

applied sciences

• Special Issue "*Big Data in Construction Engineering and Management*" in Journal "*Applied Sciences*" (closed on 10 January 2022)

Guest Editors: Krzysztof Zima, Agnieszka Leśniak, María Dolores Andújar-Montoya, Ali Ghaffarian Hoseini https://www.mdpi.com/journal/applsci/special\_issues/BD\_CEM

sustainability

 Special Issue "Decision-Making Approaches to Support the Sustainability of Supply Chain System in Pandemic Disruptions" in Journal "Sustainability" (closed on 28 February 2022)

Guest Editors: Morteza Yazdani, Prasenjit Chaterjee, Ahmed Maher, Ernesto D.R. Santibanez-Gonzalez https://www.mdpi.com/journal/sustainability/special\_issues/decision\_making\_supply\_chain\_



• Special Issue "Sustainable Enterprise Resources Planning Systems: Current Status, Challenges, and Future Directions" in Journal "Sustainability" (closed on 30 July 2022)

Guest Editors: Abdoulmohammad Gholamzadeh Chofreh, Feybi Ariani Goni, Abbas Mardani, Syuhaida Ismail https://www.mdpi.com/journal/sustainability/special\_issues/sustainable\_enterprise



International Journal of Environmental Research and Public Health

• Special Issue "*Healthcare Circular Economy: Opportunities and Challenges*" in Journal *"International Journal of Environmental Research and Public Health"* (closed on 30 June 2022)

*Guest Editors: Abbas Mardani, Abdoulmohammad Gholamzadeh Chofreh, Syed Abdul Rehman Khan* <u>https://www.mdpi.com/journal/ijerph/special issues/Circul Health</u>

### algorithms

• Special Issue "*Multiple Criteria Decision Making Algorithms in Engineering and Management*" in Journal "*Algorithms*" (closed on 31 May 2022)

*Guest Editors: Edmundas Kazimieras Zavadskas, Zenonas Turskis, Jurgita Antuchevičienė* <u>https://www.mdpi.com/journal/algorithms/special\_issues/MCDM\_algorithms</u>

# sustainability

• Special Issue "Sustainable Construction Engineering and Management: Enablers of Change, Part II" in Journal "Sustainability" (closed on 20 December 2022)

Guest Editors: Edmundas Kazimieras Zavadskas, Jurgita Antucheviciene, M. Reza Hosseini, Amirhosein Ghaffarianhoseini <u>https://www.mdpi.com/journal/sustainability/special\_issues/construction\_engineeringII</u>

### **Open Special Issues:**



• Special Issue "*Multi-Criteria Decision Making and Data Mining*" in Journal *"Mathematics"* (Deadline for manuscript submissions: **31 December 2022**)

Guest Editors: James Liou, Artūras Kaklauskas https://www.mdpi.com/journal/mathematics/special issues/Multi criteria Decision Making D ata Mining



### mathematics

• Special Issue "*Multi-Criteria Decision Making and Data Mining II*" in Journal *"Mathematics"* (Deadline for manuscript submissions: **31 December 2023**)

*Guest Editors: James Liou, Artūras Kaklauskas* <u>https://www.mdpi.com/journal/mathematics/special issues/22V910Y0HL</u>



### mathematics

• Special Issue "*Multiple Criteria Decision Making 2022*" in Journal *"Mathematics"* (Deadline for manuscript submissions: **30 December 2022**)

### Guest Editors: Violeta Keršulienė, Zenonas Turskis

https://www.mdpi.com/journal/mathematics/special\_issues/Multiple\_Criteria\_Decision\_Makin g\_2022



International Journal of Environmental Research and Public Health

• Special Issue "*Occupational Safety and Risks in Construction*" in Journal "*International Journal of Environmental Research and Public Health*" (Deadline for manuscript submissions: **31 August 2023**)

*Guest Editors: Jolanta Tamošaitienė, Jerzy Pasławski* <u>https://www.mdpi.com/journal/ijerph/special issues/occupational safety risks</u>



• Special Issue "*Analysis on Real-Estate Marketing and Sustainable Civil Engineering*" in Journal *"Sustainability"* (Deadline for manuscript submissions: **30 June 2023**)

*Guest Editors: Natalija Lepkova, Laura Tupėnaitė* <u>https://www.mdpi.com/journal/sustainability/special issues/estate marketing</u>

## sustainability

 Special Issue "Architectural, Civil, and Infrastructure Engineering in View of Sustainability" in Journal "Sustainability" (Deadline for manuscript submissions: 30 January 2023)

*Guest Editors: Oleg Kapliński, Lili Dong, Agata Bonenberg, Wojciech Bonenberg* <u>https://www.mdpi.com/journal/sustainability/special issues/View of Sustainability</u>



• Special Issue "*Construction Management – Future Innovations, Methods, Techniques and Technologies*" in Journal "*Buildings*" (ongoing Topical Collection)

*Guest Editors: Agnieszka Leśniak, Krzysztof Zima* <u>https://www.mdpi.com/journal/buildings/special issues/Construction Management Innovatio</u> <u>n\_Methods\_Technologies</u>



 Special Issue "Intelligent Multi-Criteria Decision-Making Methodologies in Building and Construction Management" in Journal "Buildings" (Deadline for manuscript submissions: 31 May 2023)

*Guest Editors: S.A. Edalatpanah, Jurgita Antucheviciene* <u>https://www.mdpi.com/journal/buildings/special issues/decision construction management</u>



 Special Issue "Sustainable Supply Chain Management in Construction: Resilience, Flexibility, and Innovation" in Journal "Buildings" (Deadline for manuscript submissions: 31 December 2022)

*Guest Editors: Audrius Banaitis, Anil Kumar, Serdar Durdyev* <u>https://www.mdpi.com/journal/buildings/special issues/sus chain construc</u>



• Special Issue "*Fuzzy Logic and Fuzzy Hybrid Techniques for Construction Engineering*" in Journal "*Applied Sciences*" (Deadline for manuscript submissions: **10 February 2023**)

### Guest Editor: Edyta Plebankiewicz

https://www.mdpi.com/journal/applsci/special issues/fuzzy logic fuzzy hybrid techniques construction engineering



• Special Issue "*Entropy for Data-Driven Decision-Making Problems*" in Journal "*Entropy*" (Deadline for manuscript submissions: **31 May 2023**)

Guest Editors: Abbas Mardani, Edmundas Kazimieras Zavadskas, Dragan Pamucar, Fausto Cavallaro https://www.mdpi.com/journal/entropy/special\_issues/9C14870ZUD



• Special Issue "*Algorithms for Multi-Criteria Decision-Making under Uncertainty*" in Journal "Symmetry" (Deadline for manuscript submissions: **31 March 2023**)

Guest Editors: Dragan Pamucar, Željko Stević, Abbas Mardani, Edmundas Kazimieras Zavadskas https://www.mdpi.com/journal/symmetry/special issues/Algorithms Multi Criteria Decision Making



Computer Modeling in Engineering & Sciences

• Special Issue "*Linguistic Approaches for Multiple Criteria Decision Making and Applications*" in Journal "*CMES-Computer Modeling in Engineering & Sciences*" (Deadline for manuscript submissions: **30 June 2023**)

Guest Editors: Huchang Liao, Xingli Wu, Abbas Mardani, Zeshui Xu, Edmundas Kazimieras Zavadskas

https://www.techscience.com/CMES/special detail/linguistic approaches



Computer Modeling in Engineering & Sciences

• Special Issue "Advanced Computational Models for Decision-Making of Complex Systems in Engineering" in Journal "CMES-Computer Modeling in Engineering & Sciences" (Deadline for manuscript submissions: **01 June 2023**)

*Guest Editors: Željko Stević, E.K. Zavadskas, Vladimir Simić* <u>https://www.techscience.com/CMES/special detail/engineering</u>



- energies
- Special Issue "*Moving towards Digitalization in Building Energy Modeling*" in Journal "*Energies*" (Deadline for manuscript submissions: **31 March 2023**)

Guest Editors: Serdar Durdyev, Saeed Reza Mohandes, David John Edwards, Edmundas Kazimieras Zavadskas

https://www.mdpi.com/journal/energies/special issues/Digitalization in Building Energy Mo deling



• Special Issue "*Symmetric and Asymmetric Data in Solution Models, Part II*" in Journal "Symmetry" (Deadline for manuscript submissions: **31 January 2023**)

Guest Editors: Edmundas Kazimieras Zavadskas, Jurgita Antuchevičienė, Zenonas Turskis https://www.mdpi.com/journal/symmetry/special\_issues/Symmetric\_Asymmetric\_Data\_Soluti on Models part II



• Special Issue "*Shaping the future of digital economy using business analytics models*" in Journal "Economic Research-Ekonomska Istraživanja" (Deadline for manuscript submissions: **30 June 2023**)

Guest Editors: Abbas Mardani, Edmundas Kazimieras Zavadskas, Reza Farzipoor Saen, Fausto Cavallaro <u>https://think.taylorandfrancis.com/special\_issues/digital-economy-</u>

models/?utm\_source=TFO&utm\_medium=cms&utm\_campaign=JPG15743

### "BUILDINGS": A growing international journal on civil engineering with an emphasis on sustainability

### Edmundas Kazimieras Zavadskas, Jurgita Antuchevičienė, Audrius Banaitis

Two years ago, an article about scientific journals published by Vilnius Gediminas Technical University was announced in the EWG ORSDCE Newsletter 2020 [1]. We presented short overviews of five journals, based on published bibliometric analyses of "Journal of Civil Engineering and Management" [2], "Technological and Economic Development of Economy" [3], "International Journal of Strategic Property Management" [4], "Journal of Environmental Engineering and Landscape Management" [5], "Transport" [6], also "The Baltic Journal of Road and Bridge Engineering" that was transferred from Vilnius Gediminas Technical University to Riga Technical University (Latvia) since 2018 [7].

The mentioned article [1] also presented bibliometric analysis of "Symmetry" journal (MDPI) [8] as the journal that published many papers related to EWG ORSDCE topical areas and Working Group members published or still have open several Special Issues in the journal.

The other journal, published by MDPI and closely related to EWG ORSDCE activities, is "Buildings".



"Buildings" (ISSN 2075-5309) is an international, peer-reviewed, open access journal (free for readers) that publishes original articles, critical reviews, research notes, and communications on building science, building engineering and architecture design:

https://www.mdpi.com/journal/buildings

Two of the Working Group members from VILNIUS TECH are included in the Editorial Board of the journal – the Coordinator of EWG ORSDCE Prof Dr Audrius Banaitis and Prof Dr Jurgita Antuchevičienė:

https://www.mdpi.com/journal/buildings/editors?search=vilnius+gediminas+technical+univer sity The Special Issue "Sustainable Development of Buildings: Design, Construction, Quality Inspection, Operation Management", edited by former Coordinator of our Group Assoc Prof Dr Tatjana Vilutienė and Prof Dr Audrius Banaitis together with colleagues from Hong Kong Polytechnic University, Deakin University and University Politecnica de Catalunya, collected 12 papers on the actual topics of sustainable construction and sustainable buildings:

https://www.mdpi.com/journal/buildings/special issues/Sustainable Buildings

The Special Issue "Sustainable Supply Chain Management in Construction: Resilience, Flexibility, and Innovation", edited by Prof Dr Audrius Banaitis in collaboration with Prof Dr Anil Kumar (London Metropolitan University, UK) and Dr Serdar Durdyev (Ara Institute of Canterbury, New Zealand) is still waiting for submissions:

https://www.mdpi.com/journal/buildings/special issues/sus chain construc

The Special Issue "Intelligent Multi-Criteria Decision-Making Methodologies in Building and Construction Management", edited by Prof Dr Jurgita Antuchevičienė and Dr S.A. Edalatpanah (Department of Applied Mathematics, Ayandegan Institute of Higher Education) has attracted many papers on developments and applications of multi-criteria decision-making methods, and future submissions are still welcome. Deadline for manuscript submissions is 31 May 2023. Call for Papers can be found here:

https://www.mdpi.com/journal/buildings/special issues/decision construction management

Journal "Buildings" celebrated its 10th anniversary in 2021, therefore the bibliometric analysis of publications of the journal in a period of 2011 – 2021 was developed and published in 2022 [9].

"Buildings" was founded in 2011 as a quarterly journal. In 2017 the journal started new era of development when Prof Dr David Arditi became the Editor-in-Chief, the journal increased the number of issues and began to publish every month and became well recognized by the scientific community. It was indexed in Scopus (Elsevier) and the Science Citation Index Expanded (SCIE) of Web of Science Clarivate Analytics and received its first impact factor for 2020. When the bibliometric paper was being prepared, according to the Journal Citation Reports (JCR) of the Web of Science, the journal's 2020 impact factor was 2.648, ranking 32nd of 67 journals in the category of Construction & Building Technology (Q2) and 61st of 137 in Engineering, Civil (Q2). Next year the impact factor raised up and reached 3.324 (Fig. 1), the journal's ranking also raised by several positions in both categories, however, the JCR quartiles remained the same, Q2: Construction & Building Technology and Q2: Engineering, Civil. Number of citable items and citations is presented in Fig. 2.



Fig. 1. Impact factor (<u>https://www.mdpi.com/journal/buildings/stats</u>)

EURO



### Fig. 2. Citable Items & Citations (<u>https://www.mdpi.com/journal/buildings/stats</u>)

Meanwhile in Scopus the journal is ranked even higher and reaches Q1 in Architecture, also Q2 in Building and Construction as well as in Civil and Structural Engineering.

The analysis shows the strong growth of "Buildings" over time. In 2022, number of publications as well as citations drastically increase (Fig. 3).





In the analysis carried in 2021 [9] the main keywords were identified and visualized with the help of word cloud (Fig. 4). The 50 most frequent author keywords are showed. The size of words in the picture demonstrates the word's frequency of occurrence. It was found that the keyword "sustainability" is the main in the graph, followed by "energy efficiency" and "thermal comfort". "Buildings", "BIM" (Building Information Modelling) and "construction" also show their great importance. "Climate change" has been a hot topic in recent years, especially in fields such as architecture and the environment. And this I not surprisingly, as the subjects of "Architecture" and "Environmental Engineering" are among the leading subjects in the journal (Fig. 5).



Fig. 4. Word cloud of keywords of "Buildings" [9]

Rank	Subject	Publications
1	Civil Engineering	823
2	Architecture	<u>713</u>
3	Characterization and Testing of Materials	<u>328</u>
4	Environmental Engineering	<u>214</u>
5	Information and Library Science	<u>168</u>
6	Industrial Engineering	<u>113</u>
7	Transportation Science and Technology	<u>80</u>
8	Geological Engineering	<u>55</u>
9	Paper and Wood	<u>49</u>
10	Remote Sensing	<u>45</u>

Fig. 5. Top subjects of "Buildings" (<u>https://app.scilit.net/sources/2220</u>)

We invite the interested colleagues to read the entire paper [9]. The analysis showed that the journal is closely related to EWG ORSDCE topical research areas.

### **REFERENCES:**

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https://www.euro-online.org/websites/orsdce/wp-content/uploads/sites/16/2020/12/EWG-ORSDCE-Newsletter-2020.pdf

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https://journals.vilniustech.lt/index.php/IJSPM/article/view/10535/9324

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### International recognition

Congratulations to the members of EWG-ORSDCE prof. Zenonas Turskis and Dr. Abbas Mardani recognized being among the world's most influential researchers of the past decade, demonstrated by the production of multiple highly-cited papers that rank in the top 1% by citations for field and year in Web of Science. Experts from the Institute for Scientific Information provide exclusive insight into the list of Highly Cited Researchers 2022, including the methodology, country, and institutional breakdowns, and much more.

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# *Vilnius Gediminas Technical University (VILNIUS TECH) scientists are among the 2 percent best in the world*

September 2022 data-update for "Updated science-wide author databases of standardized citation indicators"

Published: 10 October 2022 | Version 4 | DOI: <u>https://doi.org/10.17632/btchxktzyw.4</u> Contributor: John P.A. Ioannidis

Stanford University, together with the publishing house Elsevier and SciTech Strategies, has created a ranking of 2% of the best scientists in the world. The dataset in version 4 is based on the Sept 1, 2022 snapshot from Scopus, updated to end of citation year 2021. Work uses Scopus data provided by Elsevier through ICSR Lab (<u>https://www.elsevier.com/icsr/icsrlab</u>).

35 scientists from Lithuania were listed in the ranking, including 5 VilniusTech employees: Zavadskas E., Turskis Z., Kaklauskas A., Antuchevičiene J., Kaklauskas G.

### "AD Scientific Index" (Alper-Doger Scientific Index)

The AD Scientific Index (Alper-Doger Scientific Index), unlike other systems that provide evaluations of journals and universities, is a ranking and analysis system based on the scientific performance and the added value of the scientific productivity of individual scientists. Furthermore, it provides rankings of institutions based on the scientific characteristics of affiliated scientists. This new index has been developed by Prof. Dr. Murat ALPER (MD) and Associate Prof. Dr. Cihan DÖĞER (MD) by using the total and last 5 years' values of the i10 index, h-index, and citation scores in Google Scholar. In addition, the ratio of the last 5 years' value to the total value of the abovementioned indexes is used. Using a total of nine parameters, the "AD Scientific Index" shows ranking individual scientist subject the of an by 11 (https://www.adscientificindex.com/about-us/).

Three Lithuanian scientists Zavadskas E. K. (position in region 1035) and Turskis Z. (position in region 6600) both from VilniusTech, and Ramanavičius A. (position in region 9328) from VU were listed in the European Top 10,000 scientists.

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### *Newly developed or extended methods*

Amiri, M., Hashemi-Tabatabaei, M., Keshavarz-Ghorabaee, M., Kaklauskas, A., Zavadskas, E. K., & Antucheviciene, J. (2022). A Fuzzy Extension of Simplified Best-Worst Method (F-SBWM) and Its Applications to Decision-Making Problems. *Symmetry*, 15(1), 81. MDPI AG. http://dx.doi.org/10.3390/sym15010081

### Abstract

Today, most of the issues and challenges faced by managers and decision makers are complex and multifaceted. More clearly, due to the developments of technologies, emerging trends in various industries, competitive markets, and rapid and transformative changes in the business environment, managers and decision makers have faced an uncertain environments and issues that cannot be resolved definitively. The use of multi-criteria decision-making (MCDM) methods as a practical and decision-supporting tool allows managers to examine decision-making issues in various organizations and industries based on various criteria, alternatives, and objectives and make decisions with greater reliability. The use of fuzzy techniques and concepts in MCDM methods and their mathematical relationships makes it possible to consider complexities and uncertainties in decisions related to various issues and it can lead to better and more realistic decisions. In this paper, the simplified best-worst method (SBWM), which is one of the methods based on pairwise comparisons, has been developed using triangular fuzzy numbers (TFNs) to propose a fuzzy extension of SBWM (F-SBWM). Triangular fuzzy numbers in different symmetric and asymmetric forms have widely been used in MCDM approaches and pairwise comparisons. It is noteworthy that symmetric numbers are used when we are using equal division of the domain due to an increased ambiguity and lack of information. The proposed approach as a simplified fuzzy MCDM method helps managers and decision makers in various industries to solve decisionmaking problems under uncertainty without the need for complex calculations, specialized skills, and software packages. To check the feasibility and applicability of the proposed approach, two numerical examples and a computational experiment with real data are presented, and the results are analyzed and discussed. Furthermore, to check the robustness of the results obtained from the proposed approach, sensitivity analysis and comparison of methods have been performed.

Ivanović, B., Saha, A., Stević, Ž., Puška, A., & Zavadskas, E. K. (2022). Selection of truck mixer concrete pump using novel MEREC DNMARCOS model. *Archives of Civil and Mechanical Engineering*, 22(4), 173. https://doi.org/10.1007/s43452-022-00491-9

### Abstract

Construction is one of the most developed industries of this century, especially thanks to the high rate of urbanization, mobility, and the tendency to fulfill global goals. A very important component of civil engineering is adequate and modern equipment which depends on the efficiency of execution of operations and processes in construction. A novel MCDM (multi-criteria decision-making) scheme was proposed in this paper, which means the development of the original and innovative DNMARCOS (Double normalized measurement alternatives and ranking according to the compromise Solution) for choosing a construction equipment among 16 variant solutions. For determination the criteria weights, an objective MEREC was applied, whose integration with the DNMARCOS method represents an additional contribution. The obtained results show that the

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first three alternatives Magnum MK 24.4Z-80/115 RH (A1); Magnum MK 28L-5-80/115 RH (A2); Magnum MK 25 H80 RH (A3) are the best solution for a construction company. To check the robustness of the proposed DNMARCOS method, a comparative analysis was made with the extant MCDM methods, and SCC (Spearman's correlation coefficient) coefficient and WS (Wojciech Sałabun) coefficients were calculated. The final results show the justification for the development of the original and innovative DNMARCOS model.

Rogulj, K., Kilić Pamuković, J., Antucheviciene, J., & Zavadskas, E. K. (2022). Intuitionistic fuzzy decision support based on EDAS and grey relational degree for historic bridges reconstruction priority. *Soft Computing*, 26(18), 9419–9444. <u>https://doi.org/10.1007/s00500-022-07259-6</u>

### Abstract

Bridge management includes all actions in the life cycle of the bridge, to ensure its safety, stability, and functionality. Numerous problems have been identified that are primarily related to the organization of planning and the role of decision-making in the reconstruction of the historic pedestrian bridges. The planning process for the reconstruction of these bridges is crucial due to increased traffic load, poor condition, or damage to bridges. Some of these bridges are part of the cultural heritage, while some are unfairly neglected. The motivation for this research arose from the need to establish the priority for the reconstruction of historic pedestrian bridges to achieve their safety, stability, functionality, and cultural preservation. For this reason, a new decision support model based on intuitionistic fuzzy group decision-making to the multi-criteria analysis is created. The model combines multi-criteria method Evaluation Based on Distance from Average Solution and grey relational degree (GRD) with intuitionistic fuzzy theory. Three relevant decision groups of experts are formed, with the knowledge and expertise in the area of research problematic, establishing criteria for the evaluation. A new approach to the consistency of criteria weights is proposed. The intuitionistic fuzzy likelihood function is developed for the aggregation of bridge evaluations. Furthermore, GRD values are calculated to determine the reconstruction priority ranking of bridge for each decision group. The final ranking is defined by integrating Integer Linear Programming (ILP) and Ant Colony Optimization (ACO), determining spatialfunctional, time, and financial constraints.

Zavadskas, E. K., Lescauskiene, I., Juodagalviene, B., Bausys, R., & Keizikas, A. (2022). Comparison of the stair safety awareness in different target groups by applying the VASMA-C methodology. *Archives of Civil and Mechanical Engineering*, 22(4), 167. <u>https://doi.org/10.1007/s43452-022-00487-5</u>

### Abstract

There are many cases in the construction industry when decision making related to the specific elements of the single-family houses is left to the property owners. The choice of the internal stairs design is one of them. While stair-related injuries are among the most common reasons for children's accidents at home, stair safety awareness in different target groups becomes an important matter to prevent kid injuries in domestic environments. Eleven staircase parameters affecting children's safety in single-family houses were determined in this study. The online survey dedicated to collecting and assessing the importance of these parameters was constructed and spread in Lithuania. The new modification of the VASMA (Visual Analogue Scale Matrix for Criteria Weighting) methodology called VASMA-C was proposed to analyse collected data and to expose opinions differences in three target groups: experts in the field, apartment residents and house

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residents living with children. The comparative study disclosed that staircase landing is the parameter whose importance among the expert and non-expert evaluators differs the most. It was also revealed that apartment residents have the most divergent understanding of staircase safety compared with the rest of the target groups. These findings indicate that different customers need diverse information about the staircase parameters affecting children's health and the stair vendors should be aware of these demands.

Krishankumar, R., Mishra, A. R., Cavallaro, F., Zavadskas, E. K., Antuchevičienė, J., & Ravichandran, K. S. (2022). A New Approach to the Viable Ranking of Zero-Carbon Construction Materials with Generalized Fuzzy Information. *Sustainability*, 14(13), 7691. http://dx.doi.org/10.3390/su14137691

#### Abstract

This paper aims to put forward an integrated decision approach, with generalized fuzzy information for the viable selection of zero- and low-carbon materials for construction. In countries such as India, the construction sector accounts for high pollution levels and high carbon emissions. To restore sustainability and eco-friendliness, the adoption of low-carbon materials for construction is essential and, owing to the multiple attributes associated with the selection, the problem is viewed as a multi-criteria decision-making problem. Earlier studies on material selection have faced certain issues, such as the following: (i) the modeling of uncertainty is an ordeal task; (ii) the flexibility given to experts during preference elicitation is lacking; (iii) the interactions among the criteria are not well captured; and (iv) a consideration of the criteria type is crucial for ranking. To alleviate these issues, the primary objective of this paper was to develop an integrated framework, with decision approaches for material selection in the construction sector that promote sustainability. To this end, generalized fuzzy information (GFI) was adopted as the preference style as it is both flexible and has the ability to model uncertainty from the following three dimensions: membership, non-membership, and hesitancy grades. Furthermore, the CRITIC approach was extended to the GFI context for calculating criteria weights objectively, by effectively capturing criteria interactions. Furthermore, the COPRAS technique was put forward with the GFI rating for ranking zero- and low-carbon construction materials, based on diverse attributes. The usefulness of the framework was demonstrated via a case example from India and the results showed that the design cost, the financial risk, safety, water pollution, and land contamination were the top five criteria, with blended cement, mud bricks, and bamboo as the top three material alternatives for zero- and low-carbon construction. Finally, a sensitivity analysis and a comparison with other methods revealed the theoretical positives of this framework's robustness and consistency-but it also revealed some limitations of the proposed framework.

Lai, H., Liao, H., Long, Y., & Zavadskas, E. K. (2022). A Hesitant Fermatean Fuzzy CoCoSo Method for Group Decision-Making and an Application to Blockchain Platform Evaluation. *International Journal of Fuzzy Systems*, 24(6), 2643–2661. <u>https://doi.org/10.1007/s40815-022-01319-7</u>

#### Abstract

The existing score functions of Fermatean fuzzy number (FFN) show some defects. In addition, the evaluation information given by decision-makers in real decision-making processes may be several discrete values rather than single value, which cannot be represented by the classical Fermatean fuzzy set (FFS). The combined compromise solution (CoCoSo) method can get a

compromise solution by incorporating multi-aggregation strategy; however, the final aggregation operator adopted in the CoCoSo method may cause irrational results. To bridge the above gaps, in this study, we first determine a new score function of FFNs. Then, we define the hesitant Fermatean fuzzy sets based on hesitant fuzzy sets and FFSs to process uncertain information flexibly. Next, we develop an ensemble ranking approach to overcome the limitation of the original CoCoSo method regarding aggregation bias. Afterwards, we propose a hesitant Fermatean fuzzy CoCoSo method for multiple criteria group decision-making. Last, we verify its effectiveness and practicability through a case study on the selection of blockchain platform. At the same time, we perform sensitivity analysis to check the robustness of the method, and emphasize its advantages through comparative analysis.

Korucuk, S., Aytekin, A., Ecer, F., Karamaşa, Ç., & Zavadskas, E. K. (2022). Assessing Green Approaches and Digital Marketing Strategies for Twin Transition via Fermatean Fuzzy SWARA-COPRAS. *Axioms*, 11(12), 709. MDPI AG. Retrieved from http://dx.doi.org/10.3390/axioms11120709

#### Abstract

Integrating green approaches and digital marketing strategies for Information and Communication Technologies (ICTs), which reduce environmental risks to desired levels by eliminating emissions and pollution, is considered one of the most promising solutions for logistics companies. The study strives to bring a practical and applicable solution to the decision problem involving the selection of indicators for green approaches and digital marketing strategies for ICTs in the logistics sector. An integrated Fermatean Fuzzy Step-wise Weight Assessment Ratio Analysis (FF-SWARA) and Fermatean Fuzzy Complex Proportional Assessment (FF-COPRAS) methodology is applied to evaluate green approaches and digital marketing strategies. Concerning the findings, the foremost criterion is "data management," whereas the best strategy is "programmatic advertising." To the best of the authors' knowledge, there is no other study that both offers a strategy selection for the logistics industry and considers environmental protection, sustainability, digital transformation, energy costs, and social and economic factors. The study is a part of ongoing research on productivity, sustainability, the environment, digitization, recycling and estimating levels of waste reduction, as well as business practices, competitiveness and ensuring employee satisfaction and resource efficiency. Also, it investigates the similarities and dissimilarities in the green approach practices of business in logistics and determines the extent to which these practices could be reflected. It is expected to ensure a roadmap for green approach practices and to support sustainable and ecological awareness efforts for ICTs in the logistics sector. Logistics companies can select an integrated digital strategy based on green informatics that suits them using the decision model employed in this study, which can handle uncertainties effectively. In this regard, the study's findings, which focus on reaching customers and the most precise target audience in digital applications for businesses, are critical for developing strategy, plan and process.

Davoudabadi, R., Mousavi, S., Zavadskas, E., & Dorfeshan, Y. (2022). Introducing MOWSCER Method for Multiple Criteria Group Decision-Making: A New Method of Weighting in the Structure of Cause and Effect Relationships. *INTERNATIONAL JOURNAL OF INFORMATION TECHNOLOGY & DECISION MAKING*. https://doi.org/10.1142/S0219622022500663

#### Abstract

One of the most remarkable subjects in multi-criteria group decision-making (MCGDM) is determining the weight and importance of criteria. The weighting methods based on inputs are

categorized in the manifold group. This paper presents a novel method for weighting the criteria in a network structure. This approach, namely MOWSCER, is used when the relationships among the criteria are modeled by a cause-and-effect directed graph. The directed graph demonstrates the cause and effect relationship among criteria. In the presented method, the criteria are divided into three groups. The basic idea of the criteria segmentation is derived from European Foundation for Quality Management (EFQM). These groups include (1) effect criteria, (2) cause criteria, and (3) connector criteria. Then, the connector criteria are allocated fewer weights than the other two types. In other words, the introduced method follows two purposes of decreasing criteria number and appropriate allocating of weights among remaining criteria. Accordingly, first, the connector criteria are detected, so they are assigned less weight, and remained criteria are allocated a proper weight according to their importance. Furthermore, a new weighting method for determining the weights of decision makers (DMs) in group decision-making problems is presented to achieve a comprehensive manner. In the end, to prove the practicality of the proposed method, the weights of criteria and DMs are computed in a case study and two illustrative examples. Besides, to confirm the accuracy of that, it is compared with the DEMATEL method.

### *New scientific papers*

# The list presents papers co-authored by the members of EWG-ORSDCE and published in 2022 only in journals with IF.

- Abhijit Saha, Fatih Ecer, Prasenjit Chatterjee, Tapan Senapati, Edmundas Kazimieras Zavadskas, q-Rung Orthopair Fuzzy Improved Power Weighted Operators For Solving Group Decision-Making Issues, *Informatica* 33(2022), no. 3, 593-621, <u>https://doi.org/10.15388/22-INFOR496</u>
- Alattas, K., & Mardani, A. (2022). A novel extended Internet of things (IoT) Cybersecurity protection based on adaptive deep learning prediction for industrial manufacturing applications. *ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY*, 24(7), 9464–9480. <u>https://doi.org/10.1007/s10668-021-01835-w</u>
- Al-Barakati, A., Mishra, A., Mardani, A., & Rani, P. (2022). An extended interval-valued Pythagorean fuzzy WASPAS method based on new similarity measures to evaluate the renewable energy sources. *APPLIED SOFT COMPUTING*, *120*. <u>https://doi.org/10.1016/j.asoc.2022.108689</u>
- Al-Refaie, A., & Lepkova, N. (2022). Impacts of Renewable Energy Policies on CO2 Emissions Reduction and Energy Security Using System Dynamics: The Case of Small-Scale Sector in Jordan. SUSTAINABILITY, 14(9). <u>https://doi.org/10.3390/su14095058</u>
- Al-Refaie, A., Al-Hawadi, A., & Lepkova, N. (2022). Blockchain Design with Optimal Maintenance Planning. *BUILDINGS*, 12(11). <u>https://doi.org/10.3390/buildings12111902</u>
- Al-Refaie, A., Lepkova, N., & Camlibel, M. (2022). The Relationships between the Pillars of TPM and TQM and Manufacturing Performance Using Structural Equation Modeling. *SUSTAINABILITY*, 14(3). <u>https://doi.org/10.3390/su14031497</u>
- Amiri, M., Hashemi-Tabatabaei, M., Ghahremanloo, M., Keshavarz-Ghorabaee, M., Zavadskas, E., & Salimi-Zavieh, S. (2022). Evaluating barriers and challenges of circular supply chains using a decision-making model based on rough sets. *INTERNATIONAL JOURNAL OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY*, 19(8), 7275–7296. <u>https://doi.org/10.1007/s13762-021-03899-7</u>
- Amiri, M., Hashemi-Tabatabaei, M., Keshavarz-Ghorabaee, M., Kaklauskas, A., Zavadskas, E. K., & Antucheviciene, J. (2022). A Fuzzy Extension of Simplified Best-Worst Method (F-SBWM) and Its Applications to Decision-Making Problems. *Symmetry*, 15(1), 81. MDPI AG. <u>http://dx.doi.org/10.3390/sym15010081</u>
- Ansari, R., Khalilzadeh, M., Taherkhani, R., Antucheviciene, J., Migilinskas, D., & Moradi, S. (2022). Performance Prediction of Construction Projects Based on the Causes of Claims: A System Dynamics Approach. *SUSTAINABILITY*, *14*(7). <u>https://doi.org/10.3390/su14074138</u>
- Bausys, R., Zavadskas, E., & Semenas, R. (2022). Path Selection for the Inspection Robot by m-Generalized q-Neutrosophic PROMETHEE Approach. *ENERGIES*, 15(1). https://doi.org/10.3390/en15010223
- Bidel, M., Safari, H., Mahdiraji, H., Zavadskas, E., & Antucheviciene, J. (2022). A Framework for Project Delivery Systems via Hybrid Fuzzy Risk Analysis: Application and Extension in ICT. *MATHEMATICS*, 10(17). https://doi.org/10.3390/math10173185
- Cataldo, I., Banaitis, A., Samadhiya, A., Banaitiene, N., Kumar, A., & Luthra, S. (2022). SUSTAINABLE SUPPLY CHAIN MANAGEMENT IN CONSTRUCTION: AN EXPLORATORY REVIEW FOR FUTURE RESEARCH. *JOURNAL OF CIVIL ENGINEERING AND MANAGEMENT*, *28*(7), 536–553. https://doi.org/10.3846/jcem.2022.17202
- Chen, Z., Zhang, X., Rodriguez, R., Pedrycz, W., Martinez, L., & Skibniewski, M. (2022). Expertise-Structure and Risk-Appetite-Integrated Two-Tiered Collective Opinion Generation Framework for Large-Scale Group Decision Making. *IEEE TRANSACTIONS ON FUZZY SYSTEMS*, 30(12), 5496–5510. <u>https://doi.org/10.1109/TFUZZ.2022.3179594</u>

- Cong, X., Wang, S., Wang, L., Šaparauskas, J., Górecki, J., & Skibniewski, M. J. (2022). Allocation Efficiency Measurement and Spatio-Temporal Differences Analysis of Digital Infrastructure: The Case of China's Shandong Province. *Systems*, 10(6), 205. MDPI AG. Retrieved from <u>http://dx.doi.org/10.3390/systems10060205</u>
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- Dahooie, J., Estiri, M., Janmohammadi, M., Zavadskas, E., & Turskis, Z. (2022). A novel advertising media selection framework for online games in an intuitionistic fuzzy environment. *OECONOMIA COPERNICANA*, *13*(1), 109–150. <u>https://doi.org/10.24136/oc.2022.004</u>
- Dahooie, J., Kashan, A., Naeini, Z., Vanaki, A., Zavadskas, E., & Turskis, Z. (2022). A Hybrid Multi-Criteria-Decision-Making Aggregation Method and Geographic Information System for Selecting Optimal Solar Power Plants in Iran. *ENERGIES*, 15(8). <u>https://doi.org/10.3390/en15082801</u>
- Dalouchei, F., Mousavi, S., Antucheviciene, J., & Minaei, A. (2022). A Bi-Objective Model for Scheduling Construction Projects Using Critical Chain Method and Interval-Valued Fuzzy Sets. *BUILDINGS*, *12*(7). <u>https://doi.org/10.3390/buildings12070904</u>
- Davoudabadi, R., Mousavi, S., Zavadskas, E., & Dorfeshan, Y. (2022). Introducing MOWSCER Method for Multiple Criteria Group Decision-Making: A New Method of Weighting in the Structure of Cause and Effect Relationships. *INTERNATIONAL JOURNAL OF INFORMATION TECHNOLOGY & DECISION MAKING*. <u>https://doi.org/10.1142/S0219622022500663</u>
- Deveci, M., Simic, V., Karagoz, S., & Antucheviciene, J. (2022). An interval type-2 fuzzy sets based Delphi approach to evaluate site selection indicators of sustainable vehicle shredding facilities. *APPLIED SOFT COMPUTING*, *118*. <u>https://doi.org/10.1016/j.asoc.2022.108465</u>
- Ecer, F., & Hashemkhani Zolfani, S. (2022). EVALUATING ECONOMIC FREEDOM VIA A MULTI-CRITERIA MEREC-DNMA MODEL-BASED COMPOSITE SYSTEM: CASE OF OPEC COUNTRIES. *TECHNOLOGICAL AND ECONOMIC DEVELOPMENT OF ECONOMY*, 28(4), 1158–1181. <u>https://doi.org/10.3846/tede.2022.17152</u>
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- Fang, R., Liao, H., & Mardani, A. (2022). How to aggregate uncertain and incomplete cognitive evaluation information in lung cancer treatment plan selection? A method based on Dempster-Shafer theory. *INFORMATION SCIENCES*, 603, 222–243. <u>https://doi.org/10.1016/j.ins.2022.04.060</u>
- Feng, Z., Wu, X., Chen, H., Qin, Y., Zhang, L., & Skibniewski, M. (2022). An energy performance contracting parameter optimization method based on the response surface method: A case study of a metro in China. *ENERGY*, 248. <u>https://doi.org/10.1016/j.energy.2022.123612</u>
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- Hajiagha, S., Dahooie, J., Kandi, N., Zavadskas, E., & Xu, Z. (2022). Sustainable Process Selection Using a Hybrid Fuzzy DEMATEL and Fuzzy Inference System. *INTERNATIONAL JOURNAL OF FUZZY SYSTEMS*, 24(2), 1232–1249. https://doi.org/10.1007/s40815-021-01221-8
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- Halmetoja, E., & Lepkova, N. (2022). Utilising Building Information Models in Facility Maintenance and Operations. *TEKNIK DERGI*, 33(5), 12351–12377. https://doi.org/10.18400/tekderg.748397
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# Recently finished and ongoing research projects

No.	Programme	Project	Short	Date	Responsible
			name	from - to	person (project manager)
1	HORIZON2020	BIM based tools for fast & efficient renovation <u>https://bim4ren.eu/</u>	BIM4REN	2018- 2022	Prof. Habil. Dr. Artūras Kaklauskas
2	Erasmus+	Integrating education with consumer behaviour relevant to energy efficiency and climate change at the Universities of Russia, Sri Lanka and Bangladesh http://beck-erasmus.com/	BECK	2018- 2022	Prof. Habil. Dr. Artūras Kaklauskas
3	Erasmus+	Minimizing the influence of coronavirus in a built environment http://microbe-erasmus.vilniustech.lt/	MICROBE	2020- 2023	Prof. Habil. Dr. Artūras Kaklauskas
4	HORIZON2020	Regeneration and Optimisation of Cultural heritage in creative and Knowledge cities <u>https://rockproject.eu/</u>	ROCK	2017- 2021	Prof. Habil. Dr. Artūras Kaklauskas
5	HORIZON2020	Students Achieving Valuable Energy Savings <u>https://saves.unioncloud.org/articles/w</u> <u>elcome-to-saves2</u>	SAVES2	2017- 2021	Prof. Dr. Audrius Banaitis

### PhD Dissertations defended during 2022

Darius SKIRMANTAS DEVELOPMENT OF A MULTIPLE CRITERIA NEUROANALYSIS METHOD AND INTELLIGENT DECISION-SUPPORT SYSTEM FOR BUILT ENVIRONMENT



#### Supervisor

Prof. Dr Habil. Artūras KAKLAUSKAS

#### **Object of the thesis**

The dissertation subject is the built environment and the stakeholders involved and willing to achieve their objectives in this environment.

#### Aim of the thesis

The dissertation aims to develop a multi-criteria built environment data analysis and decision-support method (UADARM) and system (UADARS) capable of contactless assessment of human comfort in the built environment, which would contribute to the creation of a sustainable and comfortable, human-oriented built environment.

#### **Research methodology**

The dissertation is based on scientific publications and characteristics provided by technology sensor manufacturers. The development of the UADARM method and the UADARS system is based on an integrated approach to assessing the usefulness and investment value of the project and providing recommendations to INVAR (Advanced of Project Utility and Investment Value Assessments along with Recommendation Provisions). Contactless sensors and cameras are used to measure biometric data.

#### Practical value of the research findings

By combining design programs with BIM (Building Information Modeling) and city information modelling CIM (City Information Modeling) modules and including a large volume of data that would connect the emotional state of residents, it would be possible to have a comprehensive multi-layered map of the city with various easily accessible information, used in the subsequent stages of the design of the built environment.

It would be a tool that provides guidelines to municipalities, real estate, and project developers on how to create a built environment so that people can feel comfortable in it.

The results of the dissertation and the systems developed through the study were applied in practice in the following projects:

- Horizon 2020. Regeneration and Optimisation of Cultural Heritage in Creative and Knowledge Cities (ROCK). 2017–2021.
- Competence Centre for Smart, Educational, and Adaptive Buildings (SAVAS). 2018–2021.
- Horizon 2020. Building information modelling adapted to efficient renovation (BIM4REN). 2018–2021.

#### Defended statements

- 1. Biometric data (temperature, respiratory rate, pulse, and facial emotions) and multicriteria analysis and decision support methods were combined to develop an innovative multi-criteria analysis and decision support method UADARM for the built environment. With the help of this method, a rationale was established for understanding the problems arising in complicated situations and for facilitating decision-making and modelling solutions through multi-criteria analysis of the built environment.
- 2. Using the UADARM method, an innovative multi-criteria analysis in a built environment and the decision support system was developed. It combines the theories and methods deriving from mathematics, civil engineering, computer science, economics, decision-making, and other fields. UADARM is a set of methods that are designed to solve complex problems in civil engineering and facilitate objective decision-making by stakeholders.
- 3. In comparison to self-diagnostic tests, the multi-criteria built environment data analysis and the decision-support system allow for a more objective assessment of the quantitative and qualitative aspects of the built environment based on emotional and physiological indicators.
- 4. The multi-criteria built environment data analysis and decision-support system help to identify negative factors and select the most reasonable personalised recommendations for specific individuals who seek to raise the degree of their comfort in the built environment.

#### Approval of the research findings

Five articles on the dissertation subject were published in scientific journals.

### Arvydas KIAULAKIS MODELING OF SUSTAINABLE BUILDING SOLUTIONS USING BIM TECHNOLOGIES



#### Supervisor

Assoc. Prof. Dr Tatjana VILUTIENĖ

#### Object of the thesis

The object of the dissertation research is the processes of creation of sustainable building solutions, applying BIM technologies, ensuring the implementation of sustainable development goals, and assessing the impact of BIM technologies.

#### Aim of the thesis

The thesis aims to develop a conceptual model to evaluate the impact of BIM technologies on the development processes of sustainable building and to assess the rationality of solutions through the integrated application of BIM technologies and multi-objective decision-making methods.

### Research methodology

Analytical, numerical, and case study methods were applied in solving the tasks of the dissertation. Recent research on the application of BIM technologies has been reviewed and summarized. An empirical research method, a survey, confirmed the challenges of BIM application discussed in the literature. Based on the literature analysis, methods for evaluating the impact of BIM on various project stages have been identified and systematized.

The development of BIM models examined in case studies was performed using modeling software tools. The system of indicators for the assessment of the sustainability of building solutions was developed based on the analysis of scientific articles. The relative significance of the indicators was determined by the Delphi method. Multi-criteria decision methods SAW, ARAS, and COPRAS were applied to determine the rational alternative for building reconstruction.

#### Practical value of the research findings

The proposed conceptual model would facilitate the modeling of sustainable building solutions through the integrated application of sustainability indicators, multi-criteria decision-making methods, and BIM technologies. The presented experimental studies in real projects show that the proposed model can be applied to the development of sustainable building solutions in the early design phase of a building and to assess the impact of BIM technologies on sustainable building development processes. The study results are useful for all construction participants in solving various tasks when BIM technologies are applied in a project.

The research results were put into practice in these projects:

- Horizon 2020 project "Project Network for Using BIM to Increase the Energy Buildings Performance (Net-UBIEP)," 2017–2019.
- Project No. 10.1.1-ESFA-V-912-01-0029 "Development of Measures for Increasing the Efficiency of Life Cycle Processes of Public Sector Structures by Applying Building Information Modeling (BIM-LT)," 2019–2023.
- National TPP program project "Development and market testing of a prototype system for the selection of technological variants of rational passive energy efficiency measures for a sustainable building in a BIM model (BIM4NZEB-DS)", 2020–2021.

#### **Defended statements**

- 1. The proposed conceptual model allows assessing the alternative solutions comprehensively by an integrated analysis of environmental, technological, and economic factors. The application of multicriteria decision-making methods in combination with BIM technologies allows a more accurate assessment of the sustainability and attractiveness of alternative solutions.
- 2. The hybrid solution model proposed by the author, based on the application of BIM, Delphi, and multi-criteria decision-making methods, is suitable for assessing the sustainability of building solutions at an early stage of design (concept development).
- 3. Using the proposed system of BIM investment and benefit evaluation indicators allows for conducting an economic assessment of BIM impacts.

#### Approval of the research findings

Eight scientific articles were published on the topic of the dissertation.