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IFORS NEWS

International Federation of Operational Research Societies

FROM THE PRESIDENT

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This year marks the 30th anniversary of the establishment of the flagship journal of IFORS, *International Transactions in Operational Research* (*ITOR*). To celebrate this historic milestone, *ITOR* will publish several special thematic issues, including one that re-prints 30 representative and influential articles published in *ITOR* in the past 30 years. I hope readers will enjoy reading this special anniversary issue.

The name of the journal, *International Transactions in Operational Research*, was proposed by Professor Peter Bell, who was appointed the founding Editor-in-Chief. The establishment of an academic journal for IFORS provided an additional channel for the promotion and dissemination of the latest theoretical and applied research in operational research, complementing the very successful and widely-read *International Abstracts in Operations Research* that IFORS already published.

In the early years of *ITOR*, the journal became the main publication channel for papers presented at the triennial IFORS conferences. Beginning with IFORS Lisbon in 1993, conference proceedings were no longer published; instead, presenters were invited to submit articles based on their talks to the new *ITOR* journal. Thus, the early volumes of the journal consists of Special Issues of papers from the triennial IFORS and other conferences. Prof. Rolfe Tomlinson was the Editor for the Special Issues from the Lisbon 1993 conference, Prof. Paul Staehly for the 1996 Vancouver conference, Prof. Theodor Stewart for the 1999 Beijing conference and Prof. Luis Valdares Tavares for the 2002 Edinburgh conference. Around 2006, ITOR was re-structured to expand its focus beyond conference-related special issues to draw more widely for its source of articles, and to seek citation indexing which had come into fashion. Thus, I myself (together with Prof. Chris Tang and Prof. Dr. Stefan Voss) became the last of the Triennial Conference Editors for *ITOR*. The 5 issues we edited (Volumes 13:3, 14:1, 14:3, 14:5 and 14:6) for the 2005 Hawaii IFORS were the last Special Issues for the IFORS triennial conferences.

Since 2007, Prof. Celso Ribeiro has been the Editor-in-Chief of the *International Transactions in Operational Research*. Under his leadership, the Editorial Board has been expanded, and now includes over 70 Associate Editors from over 20 countries. Both submissions and readership have increased substantially. Importantly, ITOR achieved its first indexing in only 4 years, in 2011, in the Journal Citation Reports. Since 2019, an annual Best Paper Award has also been established for papers published in ITOR.

Since 2021, the publication portfolio of IFORS has diversified with the establishment of a second journal *Sustainability Analytics and Modeling* (*SAM*), published in open-access mode. The founding Editor-in-Chief is Prof. Elise Miller-Hooks. SAM publishes articles that develop mathematical modeling, optimization, data analysis, and other operational research approaches and apply quantitative methods of analytics to take on global sustainability challenges.

The two journals of IFORS – ITOR and SAM – provide a focal point for the dissemination of the latest developments in operational research of high impact, and will serve as a valuable reference for the future.

As we celebrate the 30th anniversary of *International Transactions in Operational Research*, may I wish the journal continual success for many years to come!

WHAT'S INSIDE

FROM THE EDITOR-IN-CHIEF

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Welcome to the March issue of the IFORS Newsletter!

We begin a new year with great enthusiasm and expectations about our work related to this publication. The global OR community is active, and we aim to report relevant samples of its contributions by delivering content through the different sections of the publication. By the way, this issue marks the return of the OR and Development section to the newsletter. We take this opportunity to acknowledge the work of the outgoing Section Editor, Prof. Rosiane de Freitas, and we welcome Prof. Mario Guajardo, who is taking this responsibility from the current issue onward. In the OR and Development section of this issue, colleagues from Tecnológico de Monterrey (Mexico), Sabanci Business School (Turkey) and Arizona State University (USA) report a case study on management of in-kind donations in the context of disaster relief operations. In order to consider particular characteristics of the problem, such as uncertain demand and arrival of donations, the authors develop a Markov Decision Process model. The methodology is tested with data from the Katia hurricane event, which happened in Mexico in 2017.

Regarding the other sections of the newsletter, in the Tutorial, colleagues from Sapienza University of Rome, Italy, present general concepts on the application of OR methodologies (heuristics, mathematical programming) to build classification trees, a very much used tool of machine learning. The resulting trees should have several desirable characteristics, like ease of use, transparent structure and interpretability. The authors discuss how these goals can be attained by using optimization techniques and present a mixed-integer quadratic formulation for training optimal trees. Moreover, in the OR Impact section, the team of Flexciton, a solution provider for scheduling problems arisen in the industry of integrated circuits, reports the application of optimization methodologies, namely, mathematical programming, heuristics and decomposition methods, to improve productivity at one of the factories of Seagate, a provider of data storage systems. Among other things, the article highlights the importance of the interaction of the scheduler with the manufacturing execution system and its integration with the whole management process. The Conferences section reports 23 events worldwide on OR and related disciplines, while the Book Review section reports on the volumes "Deep Learning Techniques and Optimization Strategies in Big Data Analytics" and "Risk Matrix - Rating Scheme Design and Risk Aggregation". Finally, in this issue you will find updated information on the IFORS Prize for OR in Development 2023, the forthcoming IFORS 2023 Conference, the next IFORS Global Webinar and the new IFORS Secretary

We thank all contributors, authors and section editors for their work, and we hope you enjoy the reading!

OR AND DEVELOPMENT

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SHIPMENT POLICIES FOR DONATION COLLECTION CENTERS IN MEXICO

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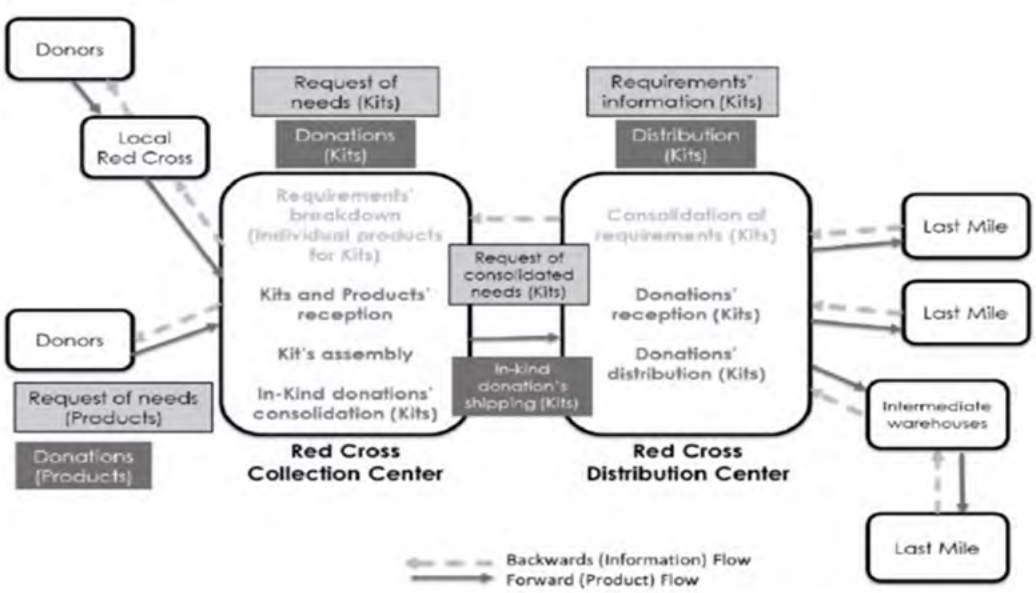
An estimated 80% of disaster relief operations involve making aid, food and other resources available to the affected people in a timely and adequate manner [1]. In many countries during the immediate aftermath of a disaster, some key inventory items are positioned at the origin of the relief supply chain through in-kind donations. An example is Mexico, where in-kind donations received in the aftermath of a disaster can go up to 80% of all donations [2]. These items range from human resources, bedding and medical supplies to food, clothing and personal hygiene products, among others; they can come through governments, the private sector or citizens.

In such humanitarian supply chains, inventory is accumulated and handled at various points throughout the network, ranging from the collecting centers to on-site distribution centers and the last mile delivery. Developing effective policies to adequately manage this inventory is essential to attending the affected communities in a timely and adequate fashion. >>

>> Figure 1 shows a schematic of the collection and distribution network of the Mexican Red Cross. In-kind donations collected from individuals and entities are sorted and organized into aid kits at the collection centers, to be distributed to the affected families through intermediate distribution centers and warehouses.



▲ Figure 1 – Mexican Red Cross Disaster Relief Network

Classical inventory strategies and decision-making policies hardly adjust to the diverse conditions faced in a crisis, creating a challenge for the researchers in the field of humanitarian logistics to develop customized policies, strategies and models to efficiently manage and distribute the inventories of supplies in the specific case of emergency and disaster response [3], [4].

Despite the importance of in-kind donations in many countries, little research has been conducted to address their efficient management and distribution. Some researchers consider in-kind donations in disaster relief operations with the approach of material convergence [5], [6], others research the psychological drivers towards donating in cash or in-kind [7], [8]. Only a few authors like Cook and Lodree [9] address this problem considering the uncertainty of in-kind donations as well as demand in settings such as a natural disaster and its subsequent relief operations. However, the research proposed by these authors focuses solely on the minimization of unsatisfied demand.

Collection centers are continuously confronted by the uncertainty in the quantity and nature of in-kind donations that they receive, as well as the requested aid coming in from the affected communities. The convolution of these two variables creates complications in the operations management of collection and distribution centers, and the decisions to be made regarding the size and frequency of shipments, i.e., the dispatching policy of donations to the affected areas which constitutes a sequential decision making problem under uncertainty in both supply and demand.

Inspired by this challenge, and after a period of direct observation and mapping at the Mexican Red Cross, we employed Markov Decision Processes (MDP) to model the daily operations in their collection centers. Our model addresses the decision process of sending shipments to the affected areas, based on the available inventory and backlogged demand, while considering the tradeoff between the implications of unsatisfied (or late-satisfied) demand and the cost of frequent shipments. Such a model provides valuable insight to the decision makers who face this problem on a continuous basis during the critical and chaotic period of disaster response.

In this model, the length of the response period is discretized into epochs; in each epoch two variables indicate the general state of the system: inventory at hand, considered as the number of aid kits, and cumulative demand (including backlog), considered as the number of families with unfulfilled requests for aid kits.

The decision is to take a shipment action or to wait at the beginning of each epoch, based on the available inventory, the current accumulated demand, and the expected value of demand for the next period.

The costs involved in each of the two types of decisions are logistics costs such as shipping and inventory holding costs, as well as the penalty for unsatisfied demand in a critical situation such as the immediate aftermath of a natural disaster. The objective of the model is to choose the series of actions over the length of the response period, that minimize the cost function, known as the optimal policy.

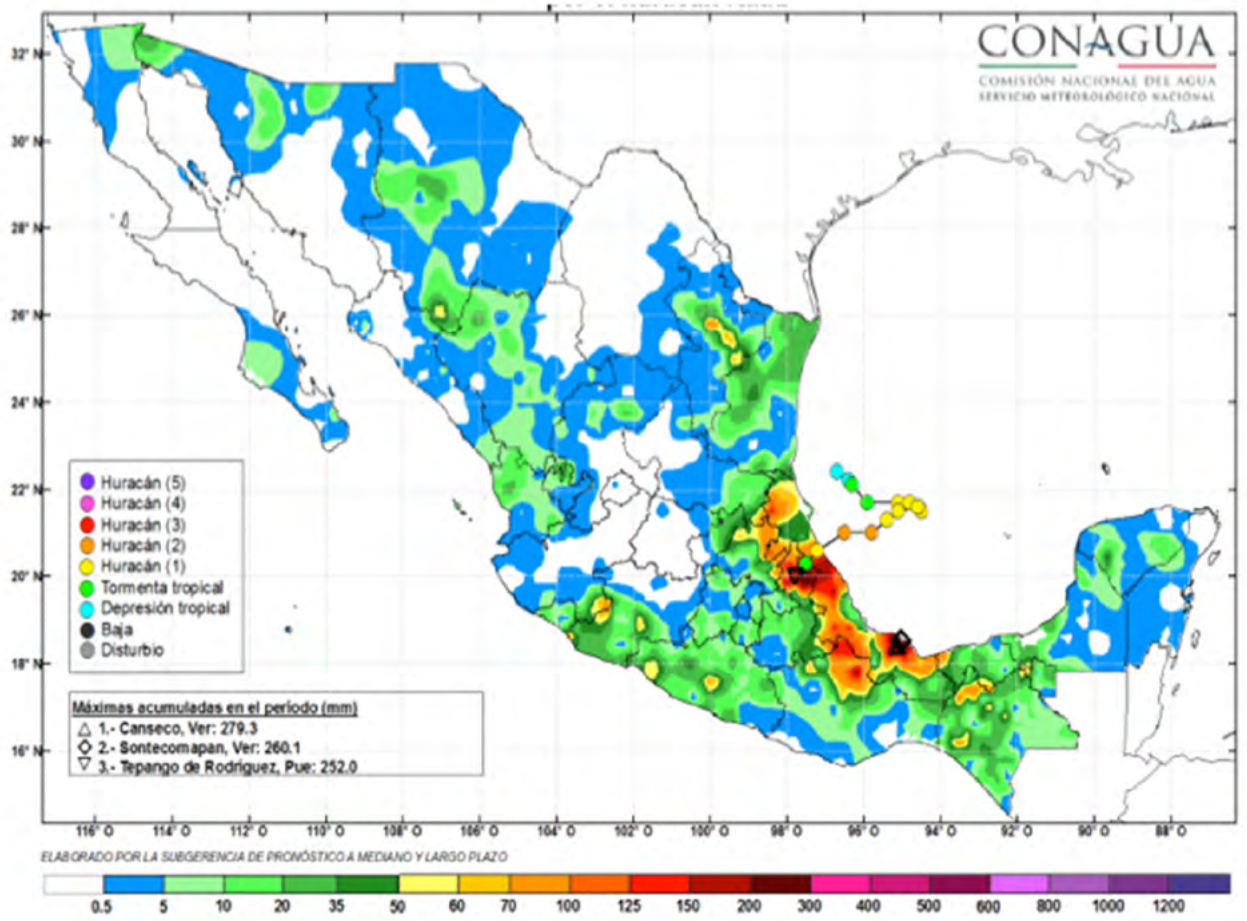
The uncertain demand that pops up at each epoch is modeled by binomial distribution, considering the total number of affected families and the probability that they request an aid kit over the next epoch. The arrival of donations is modeled as a compound Poisson distribution, considering the average number of donors that come forward at each epoch and the expected number of kits that will be provided by each donor.

Solving this model to optimality produces a policy, indicating the optimal actions to be taken at the beginning of each epoch, given the current state of the system, i.e., the at-hand inventory and the backlogged demand plus the expected incoming demand for that epoch.

For this problem structure, we prove the existence of a Monotone Optimal Non-Decreasing Policy (MONDP), which is appealing to the decision makers for its ease of applicability. This characteristic in the structure of the optimal policy guarantees a threshold of inventory and backlog demand tuple, at which the wait decision switches to taking the action of sending out shipments.

We applied this model on the case of a category 2 hurricane called Katia, which impacted the states of Veracruz and Puebla in México in September 2017. Katia left grave damages and more than 900 affected citizens by the intense winds and flooding. The input data was collected from various sources and the instance was formed for 52 families from the village of Xalapa that were evacuated and placed in shelters, and a Collection Center with a capacity of 30 kits that was put in place to serve them. Figures 2 and 3 show the path of the eye of Katia and its precipitations.

▲ Figure 2 – Probable Path of the Eye of Hurricane Katia



▲ Figure 3 – Precipitation Levels in the Hurricane Stricken Areas

The results of this case presented the MONDP in 68% of the inventory levels. The levels of inventory that represent the policy were mostly at the extremities of the range in our instant. Limited sensitivity analysis on the costs was performed, without showing any improvements in the policy. A more detailed account of this case study and methodology can be found in [10].

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OPTIMIZATION-BASED APPROACHES FOR LEARNING OPTIMAL CLASSIFICATION TREES

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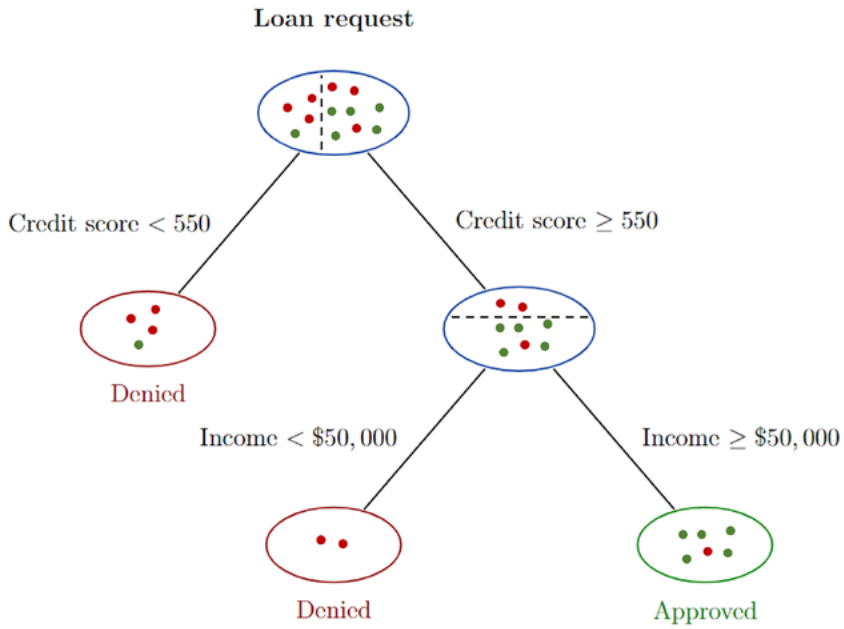
Supervised Classification and Classification Trees.
In the context of supervised classification, a set of samples belonging to different classes is given, and the goal is to build a Machine Learning (ML) model for classifying new samples into the correct class. Mathematical optimization plays a major role in the training phase, i.e. the process of building such ML models. In this phase, the aim is not solely to identify a model which correctly classifies all the input data, but rather one which is capable to generalize to never seen data. Classification problems are faced in many real-world contexts, including medical diagnosis (to diagnose a patient based on symptoms, medical history, and other factors), fraud detection (to identify fraudulent activities by analyzing patterns in financial transactions) and credit scoring (to assess the creditworthiness of borrowers and make informed lending decisions), etc. In such high stakes domains, it is crucial to use interpretable ML models [12], which can provide explanatory insights on their decision-making process. Decision trees are among the most popular Supervised ML tools for solving classification tasks. They are renowned for their ease of use, transparent structure, and, most of all, for their interpretability. Indeed, the logic of a classification tree is easily understandable by humans and it is straightforward to extract decision rules from the model as a conjunction of predicates, in contrast to other machine learning methods that are perceived as opaque "black boxes".

Fig. 1 reports a toy example of a classification tree trained to classify customers for the approval or denial of a loan request. According to the decision rule defined by the tree, first if the applicant has a credit score above 550, the loan request is approved; otherwise if the applicant has a stable source of income above $50,000, the loan request would be approved too; otherwise it is denied.

More formally, let us consider a training dataset composed of P samples (x^i, y^i), each with input *features* $x^i \in R^n$ and a *class label* $y^i \in \{1, \ldots, K\}$, indicating which of the K possible classes the sample i belongs to. During the training phase, a classification tree method builds up a binary tree structure of a maximum predefined depth. A decision tree is composed of *branch nodes* and *leaf nodes*. Each branch node t applies a splitting rule on the feature space, routing samples to its left or right child node. Each splitting rule is defined by a separating hyperplane $H_t(x) := \{x : h_t(x) = 0\}$, where $h_t(x) = a_t^T x - b_t$ is the hyperplane function and $a_t \in R^n$ and $b_t \in R^n$. If $h_t(x^i) \geq 0$, sample i will follow the right branch of node t, otherwise it will follow the left one. Leaf nodes are the terminal nodes of the tree and they act as collectors of samples. In particular, each leaf is assigned a class label according to some simple predefined rule, usually the most common label among the samples in the node.



▲ Figure 1: Classification tree example.

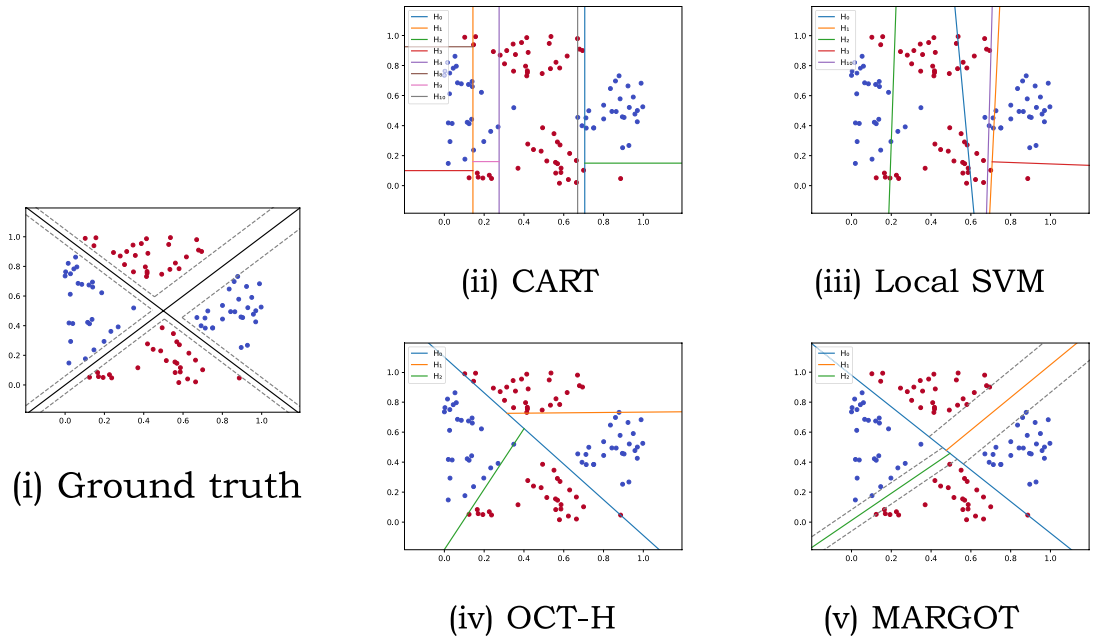
Decision trees can be divided into *univariate* and *multivariate* trees depending on the type of hyperplane splits employed. In a univariate tree, hyperplanes are axis-aligned involving one single feature per split. Thus, the branching rule simply checks if the value of a single feature x_t is above or under a given threshold b_t. Multivariate trees, instead, apply oblique hyperplanes which may involve several features. Consequently, multivariate splits allow for more flexibility yielding shallow trees with less branching levels than univarate ones, even though they are less interpretable. According to the hierarchical tree structure, the feature space will be recursively partitioned into disjoint regions and each final partition corresponds to a leaf node. Each sample in the leaf will be classified with the same class label, the one assigned to the leaf. The obtained tree is then used to classify out-of-sample data: every new sample will follow a unique path within the tree ending up in a leaf node. The training phase aims at finding coefficients a_t and b_t and at assigning class labels to leaves optimizing some measure of performance.

Overview on Classification Trees

It is well-known that learning an optimal binary decision tree is an *NP*-complete problem [11]. For this reason, traditional approaches build univariate decision trees based on simple iterative heuristics. In general, they rely on a top-down greedy strategy for growing the tree by generating splits at each node, and, once the tree is built, a bottom-up pruning procedure is applied to handle the complexity of the tree, i.e. the number of splits. Breiman et al. [6] developed a heuristic algorithm known as CART (Classification and Regression Trees), for finding univariate decision trees. Starting from the root node, each hyperplane split is generated by minimizing a local impurity function, e.g. the Gini impurity for classification tasks. Other univariate approaches employing different impurity functions were later proposed by Quinlan (ID3, C4.5). The main drawback of these approaches lies on their greedy nature which may lead to myopic decisions. Indeed, each split is determined in isolation in the tree, yielding tree classifiers not able to capture well the underlying truth of the dataset. Thus, these heuristics lead to short computational times, but may result in poor generalization performances. In order to overcome these shortcomings, tree ensemble methods, such as Random Forests and XGBoost, have been proposed. These approaches aggregate together decision trees achieving better predictive performances at the expense of lower interpretability, resulting in "black-box" models.

Another way to improve prediction quality which retains interpretability is to use multivariate decision trees which employ oblique hyperplane splits. In this case, top-down greedy approaches are not efficient and cannot be used anymore. In the last years, there has been a growing interest in the defintion of exact optimization approaches to find Optimal Classification Trees (OCTs) using mathematical programming tools and, in particular Mixed Integer Programming (MIP). Thanks to the great improvement of both algorithms for MIP and hardware, MIP approaches became viable in the construction of OCT models. Such approaches adopt an holistic view of the decision tree to define a single optimization model accounting for the tree hierarchical structure. Indeed, the MIP framework is perfectly suitable to express the combinatorial nature of the decisions involved in the construction process of a tree. Discrete decisions can be related to the tree topology and the branching rules, e.g. whether to split in a node and which features to select in a split. Other choices may regard the discrete outcomes, e.g. which leaf a sample is assigned to and whether a point is well classified. Beyond this expressive power, the mixed-integer framework also lends itself to handle global objectives and constraints to embed desirable properties such as fairness, sparsity, cost-sensitivity, robustness.

In their seminal paper [3], Bertsimas and Dunn proposed for the first time mixed-integer linear models to build optimal trees with a fixed maximum depth both with univariate splits and with multivariate ones. The objective is to seek a trade-off between the minimization of the misclassification loss and either the complexity of the tree or the sparsity of the hyperplanes. In both models, each sample is forced to end up in a single leaf (assignment constraints) and a class label for each leaf node is chosen according to the most common label rule. The classification error in the objective function is computed according to the assignment of each sample to a leaf. Routing constraints enforce each sample to follow a unique path, while other constraints control the complexity of the tree by imposing a minimum number of points accepted by each leaf. Along these lines, several other formulations have been proposed. Some of the most recent works are: [13], where the authors presented an integer linear formulation whose size is largely independent from the training data size; [10], where a mixed-integer model is derived by exploiting the special structure of categorical features for binary classification tasks; [1], where a flow-based mixed-integer linear model with a stronger linear relaxation is proposed for learning optimal trees with binary features. Alongside integer optimization approaches, continuous optimization ones have also been investigated in the optimal trees context. In [5], Blanquero et al. proposed a nonlinear programming model to find an optimal "randomized" tree with oblique splits. At each node, a random decision is made and a sample is not assigned to a class in a deterministic way but only with a given probability. For the interested reader who wishes to further investigate the topic, we suggest taking a closer look at the survey by Carrizosa et al. [7], which provides an extensive analysis of optimization approaches for constructing optimal classification trees.



▲ Figure 2: Comparison of heuristic and optimal approaches on a 2D synthetic dataset.

Maximum Margin Optimal Trees.

Following a different view point, approaches using Support Vector Machines (SVMs) [8] for each split in the tree have been investigated (e.g. [2, 4]). In this context, in [9] a novel mixed-integer quadratic formulation for training optimal trees for solving binary classification tasks is proposed. The resulting model, Margin Optimal Classification Tree (MARGOT), exploits the generalization properties of SVMs and defines branching rules as maximum margin hyperplanes by following a linear SVM paradigm in a hierarchical tree structure. The maximum depth of the tree is predetermined, and each branch node of the model defines an SVM-based problem. The overall objective function is a trade-off between minimization of the misclassification cost and the maximization of the margin of each splitting hyperplane. Routing and assignment constraints are used to nest the "local" SVM problems together. In MARGOT model, it is possible to induce sparsity of the hyperplanes by limiting the number of features used at each split. Indeed, sparsity is a core component of interpretability [12] and having fewer features selected at each branch node allows the end user to identify the key factors influencing the outcome. Two alternative versions of MARGOT are proposed which train the optimal tree performing a feature selection either by adding budget constraints on the number of used features or by penalizing the number of used features in the objective function.

Fig. 2 shows a synthetic dataset (i) used to compare two heuristic and two optimal approaches for constructing a classification tree. CART (ii) uses axis aligned splits, and it needs higher depths in order to achieve good classification performances; it is prone to overfitting. Local SVM (iii) [9] is a simple top-down approach which, for each branch node, solves an SVM problem defined only on the data routed to that node. Even though it creates oblique splits which are more flexible than ortogonal ones, the overall tree lacks of generalization capabilities. OCT-H (iv) [3] creates hyperplanes which correctly classify all samples but do not take into account their distance from the cluster of points of the same color. Finally, MARGOT (v) builds a more robust tree which mostly resembles the ground truth. The good performance of MARGOT are confirmed on a benchmark of datasets from the UCI Repository. More details about the formulations and the computational results can be found in [9]. The source code of the experiments is available at: https: //github.com/m-monaci/MARGOT.

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DEPLOYMENT OF AN ADVANCED PHOTOLITHOGRAPHY SCHEDULER AT SEAGATE TECHNOLOGY

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INTRODUCTION

Photolithography is the patterning technology used in the production of integrated circuits, ICs, also known as semiconductors and wafers, and it sets the limits on the transistor size. The process involves passing light through a series of masks onto a photo-resistant medium, which, when washed with a solvent, produces an integrated circuit. Until recently the lithographic patterns were created using lasers working at 193 nm wavelength. Since the minimum feature size in a pattern is related to the wavelength of light used, the semiconductor industry has turned to Extreme Ultraviolet (EUV) light at just 13 nm to maximise the power of ICs, coincidentally enabling Moore's Law (that the number of transistors on an IC chip doubles every 2 years, from 1965) to continue to operate.

Photolithography is the cutting edge of semiconductor wafer fabrication and requires very complex and expensive equipment. Photolithography tools, which are essential in the semiconductor manufacturing process, are usually the bottleneck area because of their high cost and the complexities around their operation, including the allocation of secondary resources such as masks. Historically, a mask or photomask is a pattern transferring device that contains the entire pattern of a single layer of a full wafer. A reticle, on the other hand, is a single layer of pattern that covers a small portion of the wafer. A reticle has to be stepped and repeated in order to expose the entire wafer. Reticles are fragile and expensive, so the minimisation of the reticle movements helps to mitigate the risk of damaging them but may sacrifice the fabricator's fundamental objective of maximising throughput.

▲ Figure 1: The Seagate factory in Northern Ireland

APPROACHES TO SCHEDULING THE PHOTOLITHOGRAPHY TOOLSET

The problem of scheduling a photolithography toolset (which consists of multiple photolithography tools that can run the same recipes) is known as the dual resource constrained (DRC) problem. Most semiconductor companies rely on non-optimising dispatch systems, although integrated approaches combining mathematical programming and dispatching rules have been proposed in the literature (1, 2) offering potential improvements to current practice but real life applications have apparently not yet been reported.

SEAGATE PHOTOLITHOGRAPHY CASE STUDY

Seagate Technology has a more than 40% share of the global Hard Disk Drive (HDD) data storage market and is at the heart of this $25bn industry. The Springtown facility in Northern Ireland, one of only 5 of its type in the world, produces around 25% of the total global demand for read-write heads for hard drives (See Figures 1 and 2). Manufacturing these products requires at least 1600 unique steps, so each wafer must be processed this number of times through a variety of tools. It takes 6-9 months to manufacture a single wafer. The tools are expensive so must be used to their fullest extent, so as to maximise throughput.

The Seagate facility includes various types of photolithography toolsets. A reticle is loaded into a scanner or stepper system where multiple exposures on to the wafer are made to cover the full patterned area. These types of toolsets, the methods of how reticles are loaded and used inside the tool, and type of reticle storage are shown in Figure 3.

The reticle stocker dispatches reticles in pods (a handling system for transferring reticles) which can hold up to six reticles. These are then placed on a load port and either moved into the internal library or remain on the load port in their pod. From a scheduling standpoint, considerations include: the wafers that need to be scheduled; their relative priorities and batching rules; which reticles they use; and which other reticles can be combined in a pod. The aim is to utilise these tools to the highest degree.

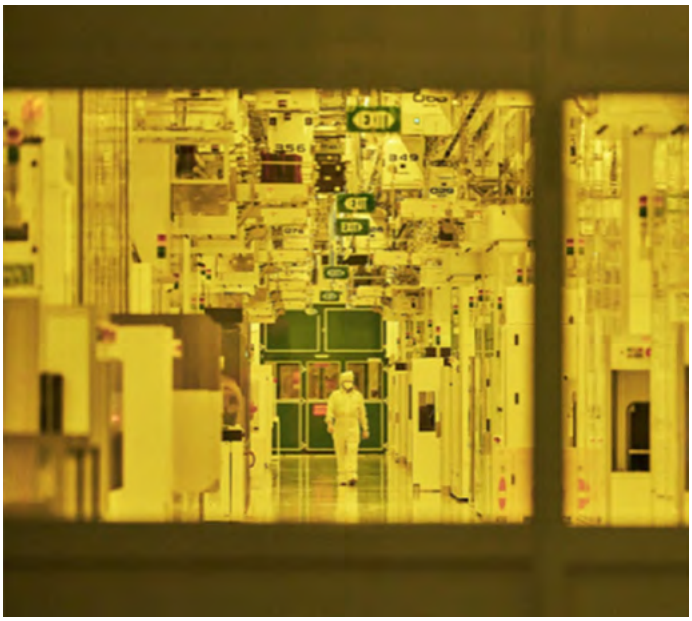
THE FLEXCITON SOLUTION

Seagate employed Flexciton, a deep technology company, focused on helping wafer fabricators to improve their production efficiency by solving their scheduling problems. The company has a team of 35 engineers and scientists who are passionate about solving scheduling problems and have published over 500 academic papers between them on this topic. >>

>> The company has developed a core product, the Flexciton Scheduler, which enables the development of optimized schedules quickly, handling all constraints and using the latest modern cloud-native technologies. Flexciton's Advanced Optimisation Technology is illustrated in Figure 4 and an Overview of the Full Fabricator Solution is shown in Figure 5. Additional technical details of the solution are given in reference 3.

The Scheduler uses a combination of mathematical programming, decomposition techniques and some heuristics to support the computationally demanding models. The solution is hosted in the cloud and it produces schedules every five minutes in a closed-loop. The data are pulled from the Manufacturing Execution System (MES) and the scheduling decisions are pushed to the dispatching system in an automatic fashion.

The Scheduler provides exact decisions on the batching of wafers into lots, reticle allocation to pods, and pod allocations to the photolithography tools. The schedules of the resources and wafers are produced simultaneously. The Scheduler has been integrated with Seagate's MES, acquiring data about the location of the wafers and the reticles and the status of the tools. The Scheduler provides the wafer schedule via Seagate's real time dispatch system. It also provides the reticle allocations to the tools through the reticle stocker, where pods with reticles are built automatically. In the case of the reticles in the reticle cabinets, operators follow the instructions of the Scheduler and transfer the reticles according to the given schedule.



▲ Figure 2: Within a Photolithography Clean room of a Wafer Fabricator

	Toolset A	Toolset B	Toolset C	Toolset D
Pod/Library	2 pod load ports	3 pod load ports	Internal Library	Internal Library
Reticle storage type	Reticle Stocker	Reticle Stocker	Reticle Stocker	Reticle Cabinets

▲ Figure 3: Types of photolithography toolsets at Seagate, Northern Ireland.

RESULTS AND IMPLEMENTATION

Hundreds of reticles are scheduled across various tools and because there is one unique reticle of each type and many complex constraints, the scheduling task is very difficult. Since deployment, the throughput of Toolset D has increased by 9.4%, lot queue time has reduced by 4.3% and at the same time the number of reticle moves has reduced by 5.3%. The comparison before and after the final deployment of the Scheduler considered live production data from multiple months for each system used in the fabricator. Additionally, operators have given positive feedback since the deployment, which supports the quantitative analysis of the improvements.

The deployment of the Scheduler requires several iterations and trials to validate data, adapt the model, integrate with Seagate's systems and agree the objective weights with different stakeholders. The cloud technology allowed for seamless trials and continuous deployments of new releases, which significantly speeded up the roll-out. A modern, user-friendly visual interface helped to explain counter-intuitive decisions by the optimisation-based Scheduler (e.g. some tools may be sub-optimised in order to optimise the entire process). Addressing the change management challenges from the beginning and frequent communication with all the parties contributed to a successful roll-out.

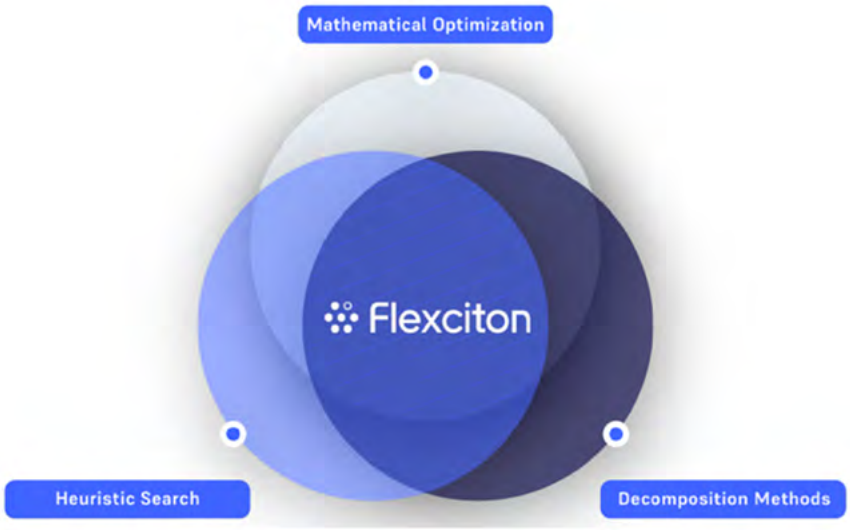
The change management process is illustrated in Figure 6. This involved training and awareness sessions for all levels of personnel involved in the manufacturing process. These sessions continued post implementation and are ongoing today, since the success of the new approach is dependent on all involved trusting the recommendations, including some which may appear counter-intuitive. After the initial sessions it was realised that an advocate with a deeper understanding of the new system was required on each shift, so some Subject Matter Experts (SMEs) were selected for additional training. These SMEs are the first port of call for troubleshooting and can help with further training of operators.

CURRENT INTEGRATION

The integration of the new scheduling system at Seagate is shown in Figure 7.

The steps involved are:

- Seagate creates the data using Activity Manager and Advanced Productivity Family software to transform/prepare the data before sending to Flexciton using web services.
- These data services generate a digital twin of the fabricator and they build all the dependencies between machines, lots, recipes, reticles and pods.



▲ Figure 4: Flexciton's Advanced Optimisation Technology

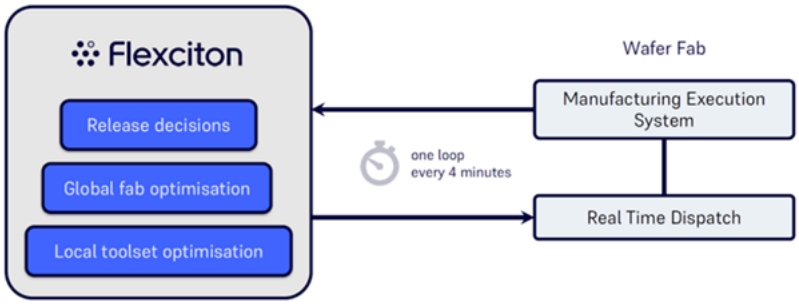


Figure 5: Overview of the Full Fabricator Solution

Figure 6: Change Management Process – End User Engagement

Figure 7: Current Integration

• Transition times between steps are calculated, and the fabricator state is updated continuously, i.e. the position of the Work in Progress, the state of the machines
• The Flexciton optimizer uses mixed integer linear programming (MILP) models and heuristics to solve the mathematical problem as mentioned earlier.
• The schedule output is returned to Seagate using web services again and with a final validation of the model output, and is fully integrated into the Real Time Dispatch.
• The dispatching system adjusts the optimal schedule to deal with last minute updates.
• The system provides a new schedule every 5 minutes to deal with uncertain parameters such transition times and processing times.

In summary, Flexciton's new scheduling system has been operating successfully since 2020 and continues to generate significant improvements for Seagate.

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RETURNING TO IN-PERSON OR CONFERENCES IN LATIN-AMERICA: XXI LATIN-IBEROAMERICAN CONFERENCE ON OPERATIONS RESEARCH - CLAIO 2022

Javier Marenco <jmarenco@dc.uba.ar>

The *Latin-Iberoamerican Conference on Operations Research* takes place biennially since 1982 and is sponsored by the *Association of Latin-Iberoamerican Operational Research Societies* (*ALIO*). The main goals of this conference are to further the exchange of experiences, to establish and deepen ties between researchers and practitioners in the region, and to help young undergraduate and graduate students in their professional development.

The *XXI edition* of *CLAIO* took place in Buenos Aires City, between December 12th and December 15th, 2022, after the unfortunate cancellation of *CLAIO 2020* due to the Covid pandemic. This edition was special since it marked the 40th anniversary of the first CLAIO, which was held in Rio de Janeiro, Brazil, in 1982.

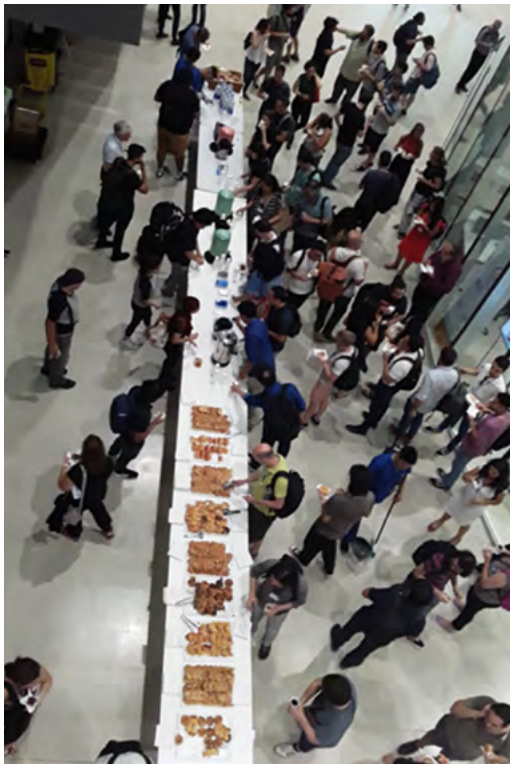
▲ *CLAIO 2022*: *Prof. Dr. Anna Nagurney* (*IFORS Distinguished Speaker*) receiving a recognition from *Prof. Dr. Antonio Mauttone* (*IFORS regional Vice President*).

In this 2022 edition we celebrated the contributions of Latin-American legends of *OR*, including *Hugo Scolnik* (University of Buenos Aires, Argentina), *Nelson Maculan* (Universidade Federal do Rio de Janeiro, Brazil), *Jayme Szwarcfiter* (Universidade Federal do Rio de Janeiro, Brazil), and *Andrés Weintraub* (Universidad de Chile, Chile). We are grateful for their work and their contributions to our discipline, and it was an honour for us to host them in *CLAIO 2022*. A special session celebrating these four giants of *OR* was held during the conference, featuring speeches by *Rafael Epstein*, *José Mario Martínez*, *Celina de Figueiredo*, and *Rosiane de Freitas*.

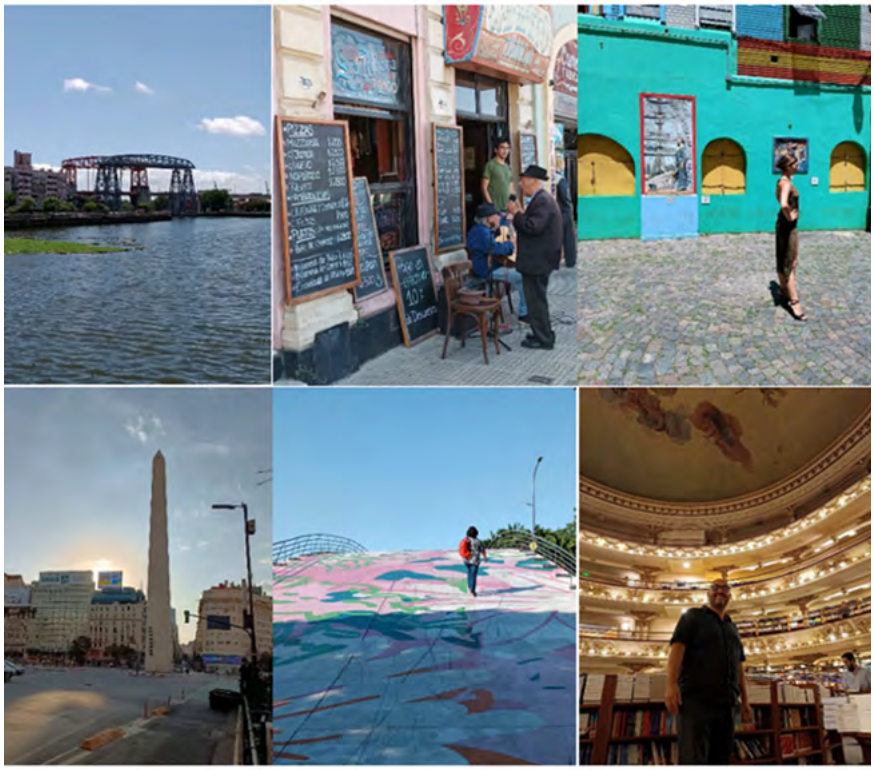
▲ *CLAIO 2022*: in the *Special Session* honouring four Latin-American *OR* legends (from left to right): *Prof. Dr. Jayme Szwarcfiter*, *Prof. Dr. Nelson Maculan*, *Prof. Dr. Andrés Weintraub*, and *Prof. Dr. Hugo Scolnik*.

The conference also hosted plenary talks by *José Mario Martínez* (Universidade Estadual de Campinas, Brazil), *Anna Nagurney* (University of Massachusetts, USA, acting as IFORS Distinguished Lecturer), *Emma Hart* (Edinburgh Napier University, UK, acting as EURO Distinguished Lecturer), *Antonio Alonso Ayuso* (Universidad Rey Juan Carlos, Spain), *Valentina Gutiérrez* (Universidad del Valle, Colombia), and *Ramon Faganello Fachini* (Mercado Libre, Argentina + Brazil + Chile). On behalf of the organizing committee, I would like to express our gratitude towards *IFORS* for the invitation of *Anna Nagurney* as *IFORS Distinguished Lecturer*, and our gratitude towards *EURO* for the invitation of *Emma Hart* as *EURO Distinguished Lecturer* for *CLAIO 2022*.

The scientific program of *CLAIO 2022* also included 341 contributed presentations organized in 92 parallel sessions. The conference hosted the *"X Encuentro de la Red Iberoamericana de Evaluación y Decisión Multicriterio (RED-M)"*, a special track on *"OR in Health and Healthcare Services"*, and a special track on the *Routing and Spectrum Allocation Problem*. Finally, *CLAIO 2022* also hosted the annual meeting of *ALIO* representatives. A total of 420 people attended the conference.



▲ *CLAIO 2022*: Gathering around the coffee break.



▲ *CLAIO 2022*: impressions of Buenos Aires by and with conference participant *Prof. Dr. Emilio Carrizosa*, gratefully acknowledged.

CLAIO 2022 marked the return to in-person conferences by *ALIO*, and it was exciting to meet colleagues and friends in Buenos Aires. Let's meet again at *CLAIO 2024* in Mexico!

Both the CLAIO 2022 full program and the abstract book can be downloaded at https://claio2022.dc.uba.ar

DATA ENVELOPMENT ANALYSIS AND STOCHASTIC FRONTIER ANALYSIS: ANNUAL COURSE WORKSHOPS

Emmanuel Thanassoulis <e.thanassoulis@aston.ac.uk>

Most recent Pre-COVID19 runs: Post COVID19 runs - online: 2017, 2018, 2019 (February and November),

Post COVID19 runs - online: 2021(June and November), 2022 (July)

Forthcoming on line run: DEA 2-4 July 2023, SFA 9-11 July 2023 https://dataenvelopment.com/course/

The *DEA* and *SFA* workshops began as courses in 2002 at the University of Aston, Birmingham, England, UK. In their initial format they were an integral part of an MSc degree programme while at the same time also being available as training courses for persons from other universities and non-academic organisations, interested in cutting edge methods for empirically assessing and managing efficiency and productivity.

▲ Aston University, Birmingham, UK.

The need for the use of the methodologies covered in the courses has become progressively more important, as the effective use of resources and improved productivity, both in the public and private sector, is ever more pressing. One particular impetus for the use of DEA and SFA and other econometric methods for efficiency analysis, covered in our courses, is due to the privatisation of utilities such as water, gas, electricity, railways, etc., in a large number of countries. Such utilities present monopolistic features and therefore countries have put regulatory systems in place to protect consumers. Regulators use the methods our courses cover to assess the scope for efficiency savings to be demanded of service providers and so protect consumers (e.g., see sample references 1 - 5).

Over time trainees from many private and public sector organisations have attended our courses including from UK regulators, consultancy companies, English water companies, Government Departments, Banks, etc. A significant proportion of attendees have also been academics or research students and post-doctoral fellows from various universities across the world who wish to have an introduction to DEA and (or) econometrics and SFA. In some cases the courses have been delivered bespoke to organisations (e.g., to the UK National Health Service and the Home Office). Post COVID19 pandemic the courses have been delivered on line. The most recent run was in July 2022. Some 14 participants from all over the world, including Australia, Malaysia, Ghana, the UK and USA, took one or both of the DEA/SFA courses. In order to make it possible for participants from as many time zones as possible to take the courses, the content of each course was delivered over 3 consecutive days. The timing of the sessions was such that the hours of the day used were as convenient as possible for most participants, though with such a span of locations over the globe, some of the participants had to wake up earlier and others stay up later than they might have otherwise wished!

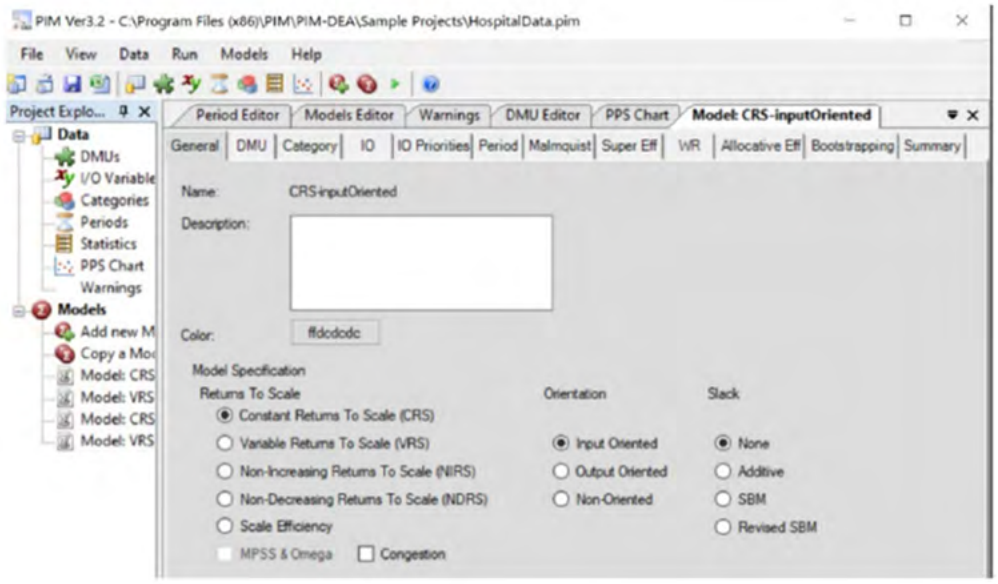
To enrol on either course formal academic pre-requisites are not needed. Participants self-select as most have some initial familiarity either with DEA or SFA or both. They take the training in order to have a formal and well-structured introduction and development of the concepts concerned. Both courses take the participant from the basic foundations of DEA and SFA and build up to a level where the participant understands the assumptions underlying each method, where it can be deployed, and its limitations. In both DEA and SFA the presentation of the concepts is interspersed with hands-on exercises demonstrating the use of DEA and SFA with the aid of related software.

The PIM DEA software (www.deasoftware.co.uk) is used for hands on sessions by participants. DEA is introduced as a general purpose method for efficiency and productivity analysis of organisations deploying complex multi-output multi-input production processes of goods and services. The classical DEA models under constant and variable returns to scale are covered, followed by more specialised variants for assessing productivity change over time, for incorporating value judgements in assessments, for target setting, for dealing with uncertainty, for exploiting economies of scale, etc. The DEA course uses various areas of application drawn from the real-life experience of the presenters to illustrate the approaches covered.

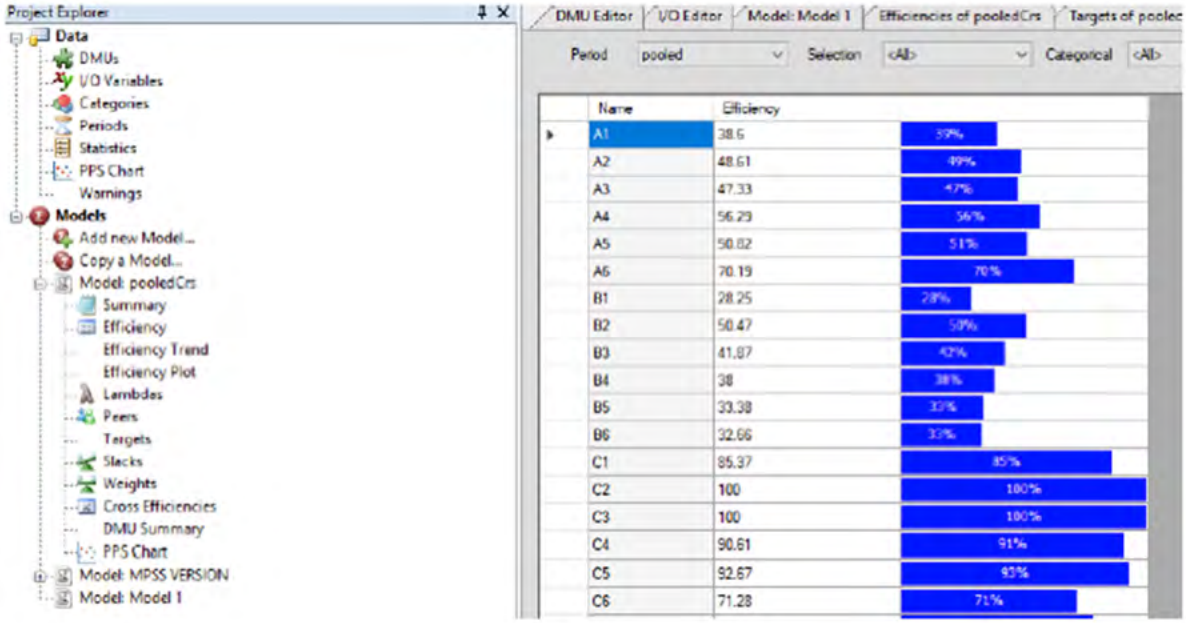
In the SFA course we introduce participants to econometric models for analysing efficiency and productivity in the production of goods or services. Participants are helped to understand the why behind the modelling process, followed by practical examples/case studies of how these models can be used in real life. >>

▲ DEA course November 2017: *Professors Thanassoulis* and *Emrouznejad* fifth and sixth from the left respectively.

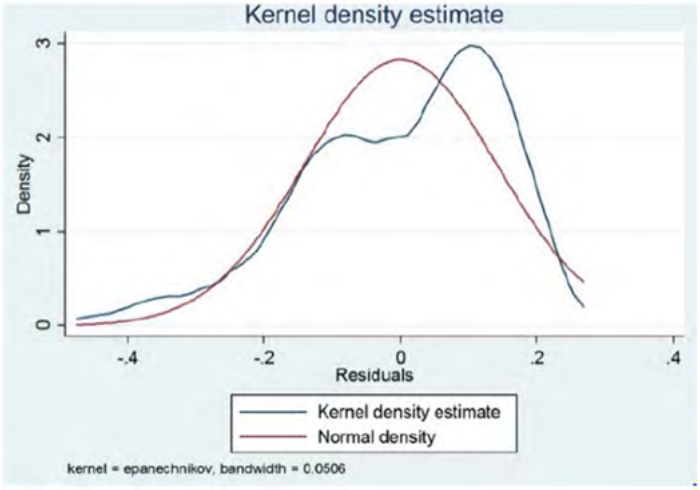
▲ *Professors Thanassoulis* delivering a paper at a DEA conference.



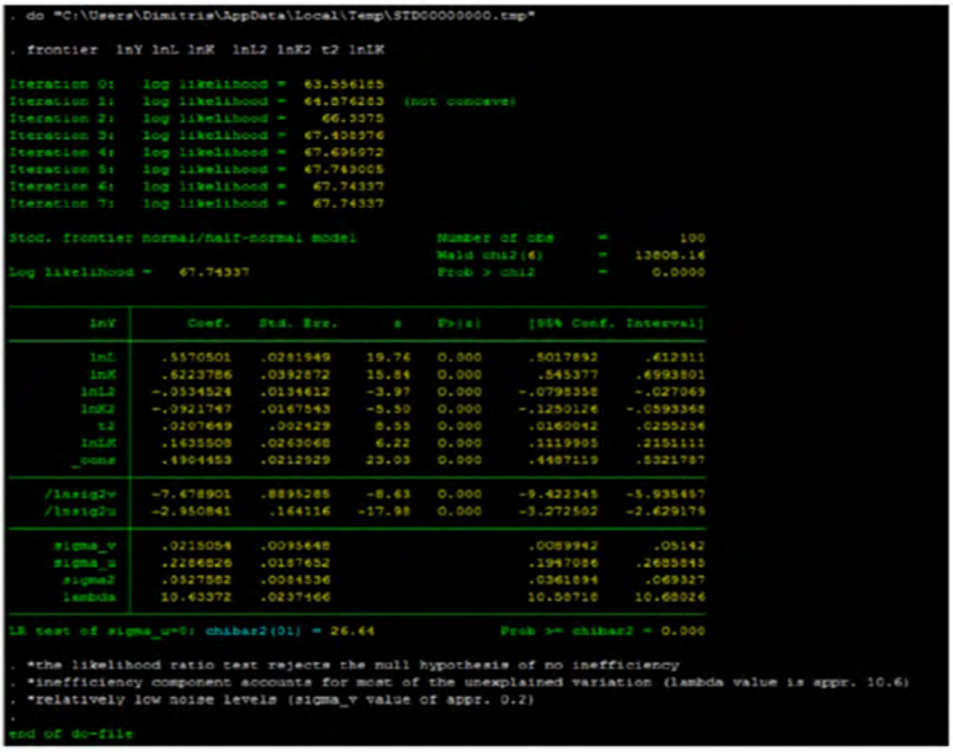
▲ PIM-DEA software: Specifying a Constant Returns to Scale Input oriented DEA model.



▲ PIM-DEA software: Sample output - relative efficiency values.



▲ Visual representation of the skewness of residuals due to the presence of inefficiency in an SFA model.



▲ Screenshot of testing for the presence of inefficiency in an SFA model.

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>> The course covers the basics of economic production theory (functions and estimation), deterministic methods for assessing efficiency (Corrected and Modified Ordinary Least Squares Regression), stochastic frontier analysis (SFA) (MLE and Method of Moments) and panel data methods for efficiency and productivity analysis. During the course we use applications that demonstrate how these tools/techniques can be applied in practice, based on case studies drawn from consultancy projects. We use the STATA statistical software package and participants receive the code used in the demonstrations directly (as a STATA .do file).

Anyone interested in one or both of the courses or wishes to find out more can visit https://dataenvelopment.com/course/ or contact *Emmanuel* on e.thanassoulis@aston.ac.uk.

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ADVANCEMENT IN DATA SCIENCE, E-LEARNING AND INFORMATION SYSTEMS, OR ONSITE AND ONLINE AT 4TH ICADEIS 2022: FOSTERING INDONESIAN-TURKISH COLLABORATION

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▲ *ICADEIS 2022*: Opening Speech by *Prof. Deden Witarsyah Jacob* (Rector of Telkom University, Indonesia).

▲ *ICADEIS 2022*: Opening Speech by *Prof. Nail Oztas* (Vice Rector of Nisantasi University, Türkiye).

The *Fourth International Conference on Advancement in Data Science, E-learning, and Information Systems 2022* (*ICADEIS 2022*), held on 23-24 November 2022, gathered the researchers, inventors, academicians, and students to experience the real opportunity to discuss new issues, tackle complex problems and find advanced enabling solutions that can shape new trends in Information Systems and Engineering. The conference was jointly organized by *Telkom University Indonesia*, Bandung, West Java, Indonesia, and *Nisantasi University*, Istanbul, Türkiye. This conference in hybrid format presented the results of research in the fields of OR and data science, especially topics and applications dealing with the Covid 19 pandemic, especially in Turkey and Indonesia, as well as in other countries.

This year, we were honoured to have distinguished *Keynote Speakers*, *Prof. Adiwijaya* (Rector of Telkom University of Indonesia), *Prof. Dr. Nail Oztas Vice* (Rector of Nisantasi University, Istanbul), Turkey, *Prof. Ilhami Colak* (Nisantasi University, Türkiye), *Prof. dr. ir. M.F.W.H.A. Marijn Janssen* (Head of the Information and Communication Technology Section the Technology, Policy and Management Faculty of Delft University of Technology, the Netherlands), and *Dr. Edi Nuryatno* (University of Western Australia).

One of the big issues at this conference is the role of data science in tackling COVID-19. The prediction of the Covid 19 pandemic is an extraordinary challenge for Data Scientists. Over-optimistic predictions will make people less aware of the dangers of this pandemic. Over pessimistic predictions will make people too afraid. How to make predictions that have high accuracy and can be scientifically accounted for is an important thing for *OR* and Data Scientists to do. The news that still needs to be cross-checked, for example, is that several developed countries are already using *Big-Data Analytics* to fight the Covid 19 pandemic. How should it be done in Indonesia and other developing countries? It is the obligation of the government, industry, and academia as well as all related elements of society to also think about and quickly develop *OR*, Data Science and Big-Data Analytics models that can be used to help overcome the Covid 19 pandemic.

One example of the role of *OR* and data science is to create a dashboard for the spread of the Covid-19 virus. Starting with the dashboard pioneered by John Hopkins University, many other dashboards have emerged that are useful for seeing the number of positive corona victims every day. After seeing how they visualize and predict, we may get some new information regarding the Covid-19 virus.

▲ Some committee members of *ICADEIS 2022* (from left to right): *Prof. Nail Oztas*, *Dr. Maria Sugiat*, *Prof. Ilhami Colak*, and *Dr. Deden Witarsyah Jacob*.

One of the other big issues is data analysis. *"The data and analysis can help people predict many things related to the pandemic"* (Murray 2020). For example, we can see the characteristics of the group (distribution). *"Processed data can help us visualize the spread of a pandemic, such as by group cluster category or by looking at the geographical area so that we can give a good early warning for the community."* (Siddiqui and Rathinam, 2021).

Obtaining important data related to the number and distribution of Covid-19 makes it easier to track this disease, thus helping to predict the possibility of someone contracting Covid or not. Analysis of the data will provide accurate information. Other data spread on social media and becoming integrated into Big Data for further processing can also help reading public sentiment.

Finally, the conference added values to your knowledge and ongoing research. The continuous support of *OR*, computational science and engineering researchers has helped *ICADEIS 2022* to become a firmly established forum in *OR-MS*, scientific computing and engineering.

Please find all of the of the conference activity on Youtube: https://www.youtube.com/watch?v=apsHy9F2xi8.

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▲ Committee of *ICADEIS 2022* celebrates friendship and conference success.

THE RESOUNDINGLY HUMAN PODCAST BY INFORMS: SHOWCASING THE INCREDIBLE CONTRIBUTIONS OF OR/MS AND ANALYTICS PROFESSIONALS

Ashley Kilgore <akilgore@informs.org>

▲ *INFORMS*: the "headshot" logo.

Did you know that drones can help provide medical care to rural communities? Or that analyzing historical data could provide key insight to fighting hate crime in today's world? Or even what is the real impact that legalizing marijuana could have on the tobacco and alcohol industries? Or even just how significant the long-term impact of interruptions to preventative healthcare during the COVID-19 pandemic will be?

All these topics and more are explored in *Resoundingly Human*, a bi-weekly *Podcast* that highlights the work of *INFORMS* members who are transforming the world around us, providing valuable insight to some of the world's most complex problems, with life- and cost-saving solutions that optimize the way we live and work.

Hosted by *INFORMS* Communications Manager *Ashley Kilgore*, *Resoundingly Human* episodes have something for everyone, from machine learning, healthcare, transportation, data ethics, artificial intelligence, the COVID-19 pandemic, marketing, and more.

Whether you are a member of one of the many science and mathematics communities, or are simply interested in learning more about how these fascinating contributions are impacting the world around you, *Resoundingly Human* will show you how members of the *INFORMS* community are saving lives, saving money, and solving problems!

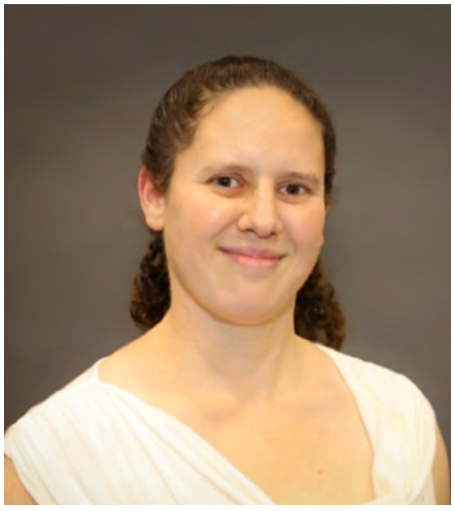
Host **Ashley Kilgore** has more than a decade of experience in nonprofit communications and public relations, including print, radio, video, podcasts, and web. In her role as the *INFORMS* communications manager, when she isn't writing, recording, or editing the podcast, she can be found crafting the weekly *INFORMS eNewsletter*, contributing to the *INFORMS* member magazine *OR/MS Today*, or brainstorming and collaborating to find creative new ways to connect with *INFORMS* members and share their incredible work!

Episodes of *Resoundingly Human* can be downloaded wherever you get your podcasts, including *Apple Podcasts, Google Podcasts, Stitcher, Spotify, Amazon Music,* and at ResoundinglyHuman.com.

INFORMS CO-HOSTS WEBINAR ON HOW TO FIND AND ASSESS FLAWED DATA ... AND DEVELOP RELIABLE SOLUTIONS

Ashley Kilgore <akilgore@informs.org>

Analytics projects universally run into challenges where the data we have is not exactly the data we want. In some cases, those limitations are obvious and easy to work around. Most of the time though, it is difficult to both find and navigate the "bad" elements of the data. Learning how to balance the business problem you are trying to solve with the available data is a key skill as a data practitioner.



▲ Co-host of an *INFORMS* and *INFORMS Practice Section webinar*: *Dr. Zohar Strinka*.

On February 9, *INFORMS* and the *INFORMS Practice Section* co-hosted a Webinar titled, *"How Do You Recognize Bad Data?"*, featuring *Zohar Strinka*, Ph.D., Analytics Strategies LLC. In the webinar, *Strinka* discussed how to find and recognize where your data has flaws as well as how to assess how they will impact your preferred analytics solution. Thinking about how the data came to exist and how it got to you is one of the key tools *Strinka* discussed for working through these challenges. Finally, she addressed the how and why for automation of data processes, which play a key role in developing reliable solutions.

A member of *INFORMS* since 2010, *Zohar Strinka* received her Ph.D. from the Industrial and Operations Engineering program at the University of Michigan. She works as a data consultant for a range of small and mid-sized companies. Early in her consulting career she realized that if you were focused on the right business problem, it was data engineering and data quality problems which were most likely to sink a promising project. Since then, she has grown her data architecture skills with a goal of consistently delivering for her clients. Ultimately, her goal is to help more people bridge the gap from data to decision.

The ***INFORMS Section on Practice*** is an *INFORMS* community whose goal is to support and help advance the practice of analytics, operations research and the management sciences, serving the entire community of full-time and part-time practitioners (https://connect.informs.org/practice/home). Among the current activities administered by the Practice Section are the Franz Edelman Award competition and Edelman Award Gala, the UPS George D. Smith Prize competition, both which are held each spring during the *INFORMS Business Analytics Conference*, as well as a practice-focused track during the *INFORMS Annual Meeting*.

OR SOLUTIONS FOR THE COUNTRY'S RECOVERY: 15TH NATIONAL CONVENTION STATISTICS IN THE PHILIPPINES

Milagros R. Baldemor <milagros_baldemor@yahoo.com.ph>

The *15th National Convention on Statistics* (*NCS*) with the theme *"Boosting the Country's Recovery with Informed Decisions, Better Policies"* was an international event held at the Crowne Plaza Manila Galleria, Ortigas Center, Quezon City, Philippines, last October 3-5, 2022.

The NCS was organized by the *Philippine Statistical System* (*PSS*) and spearheaded by the *Philippine Statistics Authority* (*PSA*). It is conducted every three (3) years and aims to: (1) provide a forum for *Operational Research* (*OR*) practitioners and theoreticians in the field of Statistics to discuss prevailing issues and emerging developments affecting the PSS; and (2) elicit the cooperation and support of Statisticians and *OR* professionals in related fields from the government, academe and private sector towards a more responsive statistical system.

The joint opening ceremony of the *33rd National Statistics Month* and the *15th NCS* was welcomed by the *Hon. Claire Dennis S. Mapa*, Undersecretary, National Statistician and Civil Registrar General of the Philippine Statistics Authority followed by the Inspirational Message of the *Hon. Arsenio Balisacan* - the National Economic Development Authority (NEDA) Socioeconomic Planning Secretary, the *Keynote Address* of *Senator Sherwin Gatchalian* and the *Plenary Talk* of *Hon. Rosemarie Edillon*, NEDA Undersecretary. Simultaneous Scientific Sessions took place in the afternoon of Day 1 until the morning of Day 3.

The event featured plenary sessions, invited and contributed paper sessions, poster presentations, panel discussions, statistical trainings and the Statistical Information Management Exhibit (SIMEx). Topics included were Statistical Applications, Innovations and Improving Business Processes (Data Science, Data Revolution, Decision Analysis), Economic Statistics, Multi-Sectoral Statistics (Data Privacy, Governance), Biostatistics (COVID-19, Epidemiology, Genetics and Bioinformatics), Statistical theory and Methodology (Econometrics, Small Area Estimation, Spatial Analysis, Time Series Analysis), Demographic and Social Statistics (Education, Housing, Migration, Social Protection, Security, Labor and Employment), Sustainability, Environment and Energy, Information management and Information and International Cooperation and Partnership. A PSAI special session was organized purposely dedicated to the former PSA Head and past PSAI President, *Prof. Lisa Grace Bersales*. All the papers underwent rigid screening by the organizing committee.

▲ *NCS 2022*: *Hon. Claire Dennis S. Mapa*, Undersecretary, National Statistician and Civil Registrar General of the Philippine Statistics Authority, giving his *Welcome Address*.

The search for the *Philippine Statistical Association, Inc.* (*PSAI*) *Best Student Paper* and the *PSAI Special Session* dedicated to the former PSA head, *Prof. Lisa Grace Bersales*, highlighted the conference. A welcome dinner in relation to the *70th PSAI Anniversary* took place in the evening of Day 2 where the awarding of the Best Student Paper and the launching of the Search for 70 Pillars by *Prof. Carmelita Ericta*, former Chairman of the National Statistics Office took place.

The *NCS* was a national activity initiated by the Philippine Statistics Authority. Its partner organization is the Philippine Statistical Association, Inc. which is a private non-stock and non-profit organization which aims to: 1. uplift and advance statistics; 2. encourage and promote the proper application and interpretation of statistics in all field of learning and endeavors; 3. work for the improvement of statistical literacy and education at all levels; and 4. serve the public by providing advice on current statistical issues and concerns. It has an official publication, *The Statistician*, which is indexed in Scopus.

The success of the *NCS* was through the combined efforts of the National Organizing Committee headed by the chairperson, *Prof. Carmelita Ericta*, the PSAI Board of Directors and Officers headed by *Prof. Rosalinda Bautista* and the support of the PSA under Undersecretary *Claire Dennis Mapa*.

▲ *NCS 2022*: after the Special Session dedicated to *Prof. Lisa Grace Bersales* (2nd from the right) with her (from the left) are the Former CHED Commissioner *Dr. Bing Osorio*, *Dr. Josefina Almeda* of the Philippine Statistical Research and Training Institute (PSRTI), Undersecretary *Dennis Mapa* and *Prof. Milagros R. Baldemor* (PSAI, Philippines) who served as the rapporteur during the said session.

▲ The winner during the Search for the *Best Student Paper*, *Tricia Janylle B. Sta. Maria* of the Institute of Statistics, University of the Philippines Los Banos. She received a Certificate of Recognition and a cash award of PhP 30,000.00 The conference brought together 1,107 participants, paper presenters or writers.

NORS 2022: THE NORWEGIAN OPERATIONS RESEARCH SOCIETY CELEBRATES PROFESSOR GILBERT LAPORTE

Peter Schütz <peter.schuetz@ntnu.no>

The *2nd Annual Conference of the Norwegian Operations Research Society* took place in Trondheim, Norway, on 29-30 November 2022. It was hosted by the Department of Industrial Economics and Technology Management, Norwegian University of Science and Technology, and organized in cooperation with the *Norwegian Operations Research Society* (*NORS*). The Annual Conference aims at being a meeting place for the Norwegian Operations Research community to discuss both ongoing and future research. In particular, it wants to provide an opportunity for PhD candidates to present their work and develop their network.

This year's *NORS* conference was attended by 50 participants from 3 countries and 11 different institutions, representing both universities, research institutes and private companies. >>

>> In total, there were 32 presentations spread across 8 sessions and addressing a wide range of topics related to industrial challenges, modelling approaches and solution methods in Operations Research. The presentations covered more theoretical problems and more applied problems from different industries (such as aquaculture, energy markets, maritime transportation, routing and scheduling problems), deterministic and stochastic optimization approaches, as well as exact and heuristic solution methods, amongst others.

The opening plenary was given by *Professor Gilbert Laporte*. In 2021, *Professor Laporte* was awarded the degree of *Doctor Honoris Cause* at NTNU and the Norwegian Operations Research wanted to celebrate and honor his scientific achievements with this plenary. In his plenary, *Professor Laporte* provided an overview over his research activities, spanning a period of 5 decades. The plenary was also streamed for the members of *NORS* that could not attend the conference.

▲ Conference Chair *Peter Schütz* welcoming the participants of *NORS 2022*.

▲ *Professor Gilbert Laporte* giving his *plenary lecture*.

The scientific program was accompanied by joint lunch and coffee breaks for the participants that provided ample time to meet both old and new colleagues. The conference dinner provided even more opportunities to exchange and discuss new (and not-so-new) ideas in a less formal setting.

Special thanks go to the organizers of the conference, the session chairs and all participants that contributed with their presentations and discussions to the success of the conference. Please also check the *NORS* homepage for more information about the Norwegian Operations Research Society: http://www.nors-online.no.

36TH ANNUAL CONFERENCE OF THE BELGIAN OR SOCIETY: ORBEL 36 CELEBRATED IN GENT, BELGIUM

Tony Wauters <tony.wauters@kuleuven.be>

On September 12-13th, 2022, the *ORBEL 36* conference was held at *KU Leuven's Technology Campus* in Gent, Belgium. *Prof. Tony Wauters* chaired the conference and was assisted by local organizers *Dr. Luke Connolly* and *Jeroen Gardeyn*. The conference also enjoyed the support of three sponsors: OMP, GUROBI and N-SIDE.

▲ Banner of the *ORBEL 36* webpage.

After a two year break due to the COVID-19 pandemic, *ORBEL 36* provided a welcome return to a live and in-person conference for members of the *Belgian Operational Research Society*. The conference proved to be a fruitful venue for discussion and the dissemination of results related to operational research, statistics, computer science and other related fields. More than 100 researchers, managers and practitioners were in attendance and had the opportunity to exchange information concerning quantitative techniques for decision making.

ORBEL 36 featured an exciting and diverse program. In total there were 66 talks given, divided across 23 parallel sessions. Some examples of parallel session themes included Passenger Transport, Sports Optimization, Scheduling, Logistics, Warehousing and Simulation Optimization. The full two-day programme and book of abstracts remains available at the conference website: https://orbel.be/orbel36/progdetail.php.

Attendees of *ORBEL 36* were treated to two plenary talks given by the conferences distinguished invited speakers, namely:

o *Prof. Michael Schneider* (RWTH Aachen University, Germany): *"Location Routing Problems: State-of-the-Art Heuristics and Recent Developments"*,

o *Prof. Antonio Martinez-Sykora* (University of Southampton, UK): *"Irregular Packing (Cutting) Problems: Models, Algorithms and Challenges"*.

Given that the conference enjoyed exceptionally fine weather, attendees of *ORBEL 36* were able to network and continue their discussions outside in the sunshine during coffee breaks and lunches. The greenery and pleasant surroundings of the Technology Campus provided the perfect venue for these interactions, as attendees sipped coffee beneath solar panels which provided electricity to the campus and thus, by extension, powered the conference.

▲ Keynote speakers at *ORBEL 36:*

Prof. Michael Schneider *Prof. Antonio Martinez-Sykora*

The conference dinner held on September 12th also provided a welcome opportunity to socialize with old friends as well as new. The dinner was held in *Brasserie Pakhuis*, a unique restaurant located in a beautifully restored warehouse in the historic city centre of Gent. More than three quarters of conferences participants joined for the banquet, which resulted in a lively and enjoyable evening for all. After dining had concluded, many of those in attendance enjoyed the spectacular sight of Gent lit up at night as they strolled by canals to continue the evening over some local Belgian beers.

▲ Interior of the *conference dinner* venue of *ORBEL 36* (*Brasserie Pakhuis*).

While the hiatus concerning in-person conferences throughout much of 2020 and 2021 was a necessary regret, we are confident that the 2022 edition of the *ORBEL* conference has begun the tradition anew. Moreover, given the lively discussions that took place it is certain that the smooth running of *ORBEL 36* not only revitalized existing academic relationships, but also lay the foundations for many future collaborations.

The *OR* team of HEC Liège, QuantOM, is happy to invite you to the *37th annual conference of the Belgian Operational Research Society* (*ORBEL 37*) which will take place on May 25-26, 2023, at HEC Liège, Belgium.

ORSC 2022 SUCCESSFULLY HELD ONLINE

Operations Research Society of China <orsc@amt.ac.cn>, **Ouyang Zhangdong** <oyzd@hnfnu.edu.cn>, **Liu Degang** <dliu@amt.ac.cn>

The *biennial conference* of the *Operations Research Society of China* was held completely online on the *Tencent Meeting Platform* on December 14-17, 2022. Over 1000 registered participants logged on the important academic event.

▲ *ORSC2022* (*online*) main page.

The conference was planned to be an in-person meeting at central China's Changsha in October, but changed as an online conference due to the hard situation of Covid infections nationwide. An opening ceremony took place in the morning of December 16, with specially invited guests from *China Association of Science and Technology*, *China's Natural Science Foundation*, *Hunan First Normal University*, and the *International Federation of Operational Research Societies* (*Prof. Janny Leung*, the President of *IFORS*).

During the *Opening Ceremony*, the *ORSC* President *Prof. Yu-Hong Dai* announced the *ORSC Fellow Award* program and unveiled the first 43 *ORSC Fellows* to honor their achievements in *OR* related research and applications and their contribution to the development of *ORSC*.

Janny Leung, the President of *IFORS* delivered a warm speech. She congratulated the opening of *ORSC2022* and recognized contribution of *ORSC* community to the development in China and in the global *OR* federation.

***ORSC Prize** winners* including the *best research prize*, the best *OR* development projects, and the *Young OR* prizes were also unveiled at the Opening Ceremony. Sessions of the finalist's presentations to the panel judge was held one day early and was broadcasted online. Through the competition, *Prof. Chen Guangya* of the Chinese Academy of Sciences won the prize of lifetime achievement, receiving the grand prize of 50,000 Yuan. *Prof. Xiu Naihua* of the Beijing Jiaotong University and *Prof. Ai Wenbao* of Beijing University of Posts and Telecommunications won the *best research prize*. Two practical applications, human identity recognition through deep learning with multiple biological features developed by the *CAS University* and *MLKEY Shenzhen* and video stabilization techniques and solvers by *Beijing Institute of Technology* and *Huawei*, were recognized as the *best OR development projects* 2022. 5 young researchers won the *Young OR Prize 2022*. Certificates and prizes of 3000-5000 Yuan each will be presented to the winners in 2023 in-person meeting in Changsha.

The two-day sessions of the *ORSC2022* included 5 plenaries and 19 invited thematic sessions with 57 speakers covering almost all the *OR/MS* areas. Two specially invited international guest speaker sessions were held in the evening of Dec 14 Beijing time, given by *Prof. Janny Leung*, the president of *IFORS* on *Public Transport for Smart Cities* and by *Prof. Marc Sevaux*, the president of *EURO*, on *Metaheuristics: Rise, Fall and Rise Again*.

The national conference of *ORSC* was held completely online for the first time, but was well-organized and enthusiastically attended, thanks to the hard work by the *ORSC* secretariat. Part of the originally planned programme will be extended to the next year's Changsha meeting hopefully at in-person format.

▲ Guest speakers at *ORSC2022 opening ceremony*.

▲ *ORSC Fellow Award 2022*.

▲ The *Young OR Prize winners*.

THE 1ST ORSHK YOUNG RESEARCHERS WORKSHOP: HONG KONG YOUNG OR TALENTS GETTING TOGETHER AND STIMULATING IDEAS

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The inaugural *ORSHK Young Researchers Workshop* was successfully held at the *University of Hong Kong* on November 26, 2022. The Workshop was jointly organised by the *Operational Research Society of Hong Kong* (*ORSHK*) and the Department of Industrial and Manufacturing Systems Engineering, the University of Hong Kong (HKU). The Workshop attracted over 60 participants, most of whom were Ph.D. students in *Operational Research* (*OR*).

In the morning, *Professor Janny Leung*, President of *ORSHK* and *IFORS*, and *Professor Max Shen*, Vice-President and Pro-Vice-Chancellor (Research) of HKU, delivered the welcome speeches.

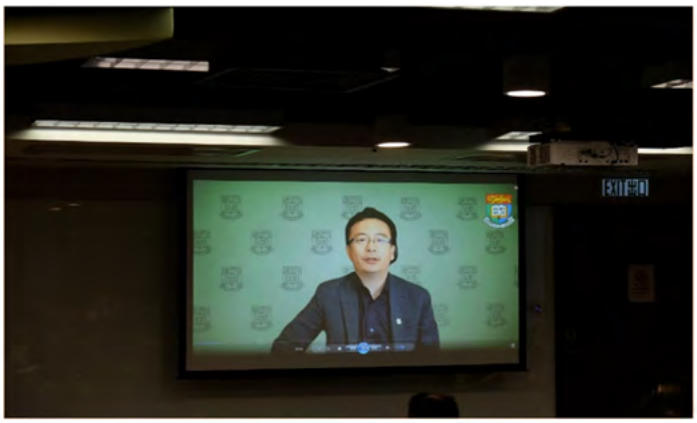
Professor Anthony So from the Chinese University of Hong Kong delivered a tutorial, titled *"Operations Research Techniques for Data Science and Machine Learning"*. *Professor So* introduced important *OR* techniques for data science and machine learning. He then presented several representative applications and discussed how the techniques could be applied to develop tractable models with performance guarantees. The tutorial was well attended, and a fruitful discussion with the participants took place.

▲ *Professor Janny Leung* welcomed the participants and presented the history of *International Federation of Operational Research Societies* (*IFORS*).

▲ *Professor Janny Leung* presented a certificate of appreciation and a souvenir to *Professor So* for his expertise, experience, and invaluable insights shared with the participants.

▲ *1st ORSHK Young Researchers Workshop*: Board of Trustees and Workshop Organisers.

▲ *Professor Anthony So* delivered a tutorial on Operations Research Techniques for Data Science and Machine Learning.



▲ *Professor Max Shen* delivered opening remarks to welcome participants to the workshop at HKU.

▲ *Young researchers* shared their research in parallel sessions.

In the afternoon, young researchers presented their on-going or recently completed research in two parallel sessions, titled *"OR Theory"* and *"OR Applications"*. In total, there were 21 oral presentations. Speakers shared their research findings, which stimulated discussions in the Q&A session and further exchanges of ideas following the workshop.

During the past three years, face-to-face research activities have been less active since the pandemic started. The objective of the workshop was to provide young researchers with a physical platform to disseminate their research ideas, collect feedback, and establish research collaborations. We also hope that, through the workshop, the *OR* community in Hong Kong can grow and continue to make significant contributions to academia and practice.

About *ORSHK*

The *Operational Research Society of Hong Kong* (*ORSHK*) has been established since 1980. The objectives of the Society are to promote the dissemination of knowledge and information relating to *Operational Research* and *Management Science* by means of meetings, publications, awards and related activities. We also aim to promote mutual interaction and cooperation among researchers, practitioners, and professional organisations, related to *Operational Research* and *Management Science* discipline, in Hong Kong.

Since 1983, *ORSHK* has been affiliated to the *International Federation of Operational Research Societies* (*IFORS*) which is currently composed of 54 national societies. More information about *ORSHK* is available at https://orshongkong.wixsite.com/home.

EURO PRACTITIONERS' FORUM: SHARING EXPERIENCES, BUILDING NETWORKS, ONLINE

Ruth Kaufman <ruth.kaufman@btinternet.com>

The Event

"Sharing Experiences, Building Networks": this is not only the title for the *EURO Practitioners' Forum* autumn half-day event at 17 November 2022, but also what everybody really wants to get out of conferences. Our challenge was to make it happen online. We chose to use *gather.town*, which is a powerful and flexible platform that supports interaction, discussion and exchange of ideas. And most of the Forum committee got involved in designing talks, discussions and formats that we hoped would exploit these capabilities.

The serious business of the afternoon started with a *plenary talk* from *Matti Vuorinen*, Director of Digital Solutions at Finnish forestry giant UPM. *Matti* was talking about some of the challenges, issues and politics around energy generation, which has developed into a key business activity for UPM. He stayed with us to host a group for our next session - *"Open Space"*, where participants were free to move between a number of different discussion groups taking place in parallel.

As well as the *"meet the speaker"* session hosted by *Matti*, *Open Space* discussion topics included "moving from proof-of-concept to implemented solution"; "machine learning"; "position of OR within an organisation"; "making your voice heard"; and others. The session didn't work quite as envisaged: one or two topics attracted no interest, whilst in other groups the conversations were so energetic that people tended to stay in the group they first entered, and had to be persuaded to move on to allow space for others to join in. But we were certainly successful in getting people talking about common issues and challenges of *practical OR*.

Open Space was followed by a return to plenary, to hear a series of 5-minute *lightning talks* – a selection from those presented at the *EURO 2022 "Making an Impact" stream* in Espoo, Finland, showcasing some of the breadth of *OR* in practice. Contributions from *Nadine-Cyra Freistetter*, *Yue Shou-Kangas*, *Colin Eden*, *Sander van Aken*, and *Jasper van Doorn* described open-source modelling for climate change mitigation; scheduling seedling deliveries (1 million per week, from 14 origins to 300 destinations); using causal mapping to bring 15 organisations to shared agreement on action to manage Covid risk; working with users in the bus industry to make sure that the right decision-support tools are both produced and used; and integrating production and transportation scheduling in the compound feed industry.

Next up was "*More, Better, Deeper*": parallel sessions exploring specific application areas in more detail. Each session was designed to have an introduction, followed by a wider discussion about the current state of play, potential developments, issues and challenges. "Chemical and process industries" led by *Claude Philippe Medard* of SAP looked at the petrochemical supply chain and the need for enterprise planning. "Airlines" focused on *OR's* contribution to airline security, led by *Andy Harrison* (Inawisdom), *Waldemar Kocjan* (Jeppesen) and *Tom Occleston* of Atkins. *Joaquim Gromicho* (Ortec) and *Helena Ramalhinho* (Pompeu Fabra University) led the discussion on how to scale up initiatives such as *'OR for a better world'* to make real impact for good. "Mobility", led by *Torkel Haufmann* and *Dag Kjenstad* of SiNTEF, described work on on-demand transportation in rural areas, to kick off discussion of mobility as a service. And finally, *Milagros Baldemor* of Don Mariano Marcos Memorial State University, Philippines, led a discussion on how *OR* can be used for decision-making in education.

We finished with a plenary, where each of the parallel session leaders fed back the key outcomes from their discussion. It was clear that many felt they had just begun to scratch the surface, and the Forum is now looking at ways to continue the discussion on these topics, and possibly extend them.

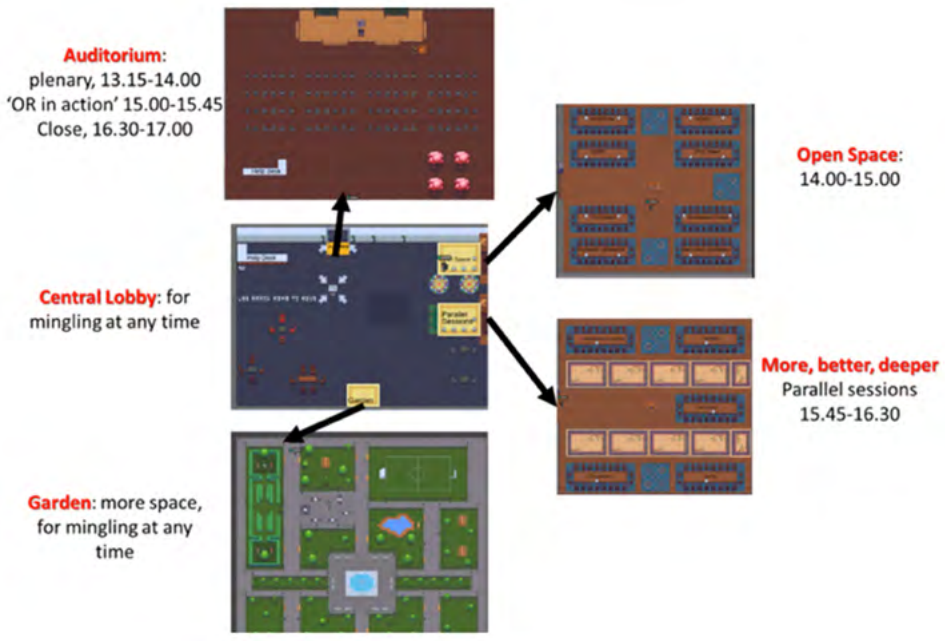
Gathering on gather.town

It is fair to say that *gather.town*, and this style of event, is not for everybody; but the great majority of the feedback we received was hugely enthusiastic.

Gather.town is one of those platforms which is highly intuitive, once somebody has explained all the details to you. It puts far more power into the hands of the user than we are used to from Zoom or Teams (for example, you can share your screen at any time, regardless of who else is sharing; and any other participant can choose to see your slides at whatever size they want from thumbnail to full-screen, or not at all; you can "personally mute" people, meaning that you don't hear them whether their mic is on or off; and you can move around to different groups whenever you want). This comes at the price of being a little confusing to people who aren't used to it, but it has great promise for an online space which enables natural interaction and reduces the cognitive overload of remote tech.

Virtual or real?

All around us, people are delighted by the return of physical meetings, and the many benefits they bring. Which is absolutely great – for those who can travel. >>



▲ *EURO Practitioners' Forum 2022*: Our meeting space on *gather.town*.

>> We are acutely aware that there are a lot of people who can't, for a lot of different reasons: family commitments, health and mobility restrictions, inadequate funding. It can be particularly difficult for practitioners, many of whom work for employers who do not recognise the value of networking, or who have become used to not having to set aside time or funding for travel.

Additional benefits made themselves apparent during the meeting: one of our speakers had an unexpected family emergency in the morning of the day he was meant to speak, and was able to put his family first; another had travel problems and was able to participate from the station waiting room. The flexibility of virtual meetings can be really valuable. So – much as the *EURO* Practitioner Forum is looking forward to our first physical event since the pandemic, in Berlin in April 2023 – we plan to continue our new tradition of *autumn online events*, and hope to build on them with other remote discussion events during the year. Sign up with the *Forum* to keep in touch with developments!

RETAIL RESET AT POST-COVID ERA: MEETING OF EURO WORKING GROUP RETAIL OPERATIONS

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Pedro Amorim <pamorim@fe.up.pt>

The *5th meeting* of the *EURO Working Group Retail Operations* took place at *Koc University*, Istanbul (Türkiye), in October 2022. The three-day meeting was the first onsite meeting after the pandemics and focused on the reset at the post-coved era in Retail. The meeting was a two day academic workshop, followed by an industry day with practitioners from the retail industry.

Co-Organizers of *EWG Retail Operations*, *Alexander Hübner* and *Pedro Amorim*.

The *EURO Working Group on Retail Operations* has been founded in 2015 by *Heinrich Kuhn* (KU Eichstätt-Ingolstadt, Germany), *Pedro Amorim* (FEU Porto, Portugal) and *Alexander Hübner* (TU Munich, Germany). The purpose of this working group is to advance the development and application of quantitative methods in the field of Retail Operations. Retail Operations emerged as a substantial and important area of research in recent years. There are several drivers of this development. Retailing is a large and growing sector of the economy in most countries, both developing and developed. For the better part of the past 50 years, the retail industry has not only been a significant contributor to the economy but also a leader in the design and development of advanced operational concepts. A recent example is the growth of omni-channel retailing, which combines online retailing with bricks-and-mortar retailing. It has changed how traditional brick-and-mortar retailers like Wal-Mart or Macy's operate their store channels, as well as how pure-play online retailers like Amazon or Alibaba operate their online channels. Retailing is a dynamic sector in which changes in markets, firms, and products occur rapidly. Recent research in retailing has discovered new applications, contexts, and theory, which promise a fertile ground for *OR* researchers for many years to come.

The working group expanded to more than 100 members nowadays. Annual meetings took place at *Castle Beilngries* (Germany, 2016, organized by *Heinrich Kuhn*), Porto (Portugal, 2017, organized by *Pedro Amorim*), Eindhoven (Netherlands, 2018, organized by *Jan Fransoo*) and Mallorca (Spain, 2019, organized by *Victor Martínez de Albéniz*. The *5th annual* took place on 12th and 13th of October, 2022, at Koç University Founders Lounge, located at Sarıyer Campus, on the beautiful hills of the Bosphorus.

Meeting *EWG Retail Operations*: during an exciting session.

The conference started with an opening speech by the organizers *Meltem Kayhan* and *Gürhan Kök* (Koc University, Istanbul) and representatives of the Turkish retailer *Migros*. The conference included talks amongst others on sustainability issues like *"Omnichannel grocery retail and food waste"* by *Pedro Amorim* (FEU Porto), *"The impact of green labels on consumer choice"* by *Frederik Eng-Larson* (Stockholm Business School) and *"Design and Pricing Problem of Eco-Friendly Products"* by *Burak Gögür* (Koc University). The second session covered behavioral topics amongst others in *"Augmented algorithms with human input"* by *Saravanan Kesavan* (UNC Kenan-Flagler Business School, Chapel Hill) and *"A behavioral study of assortment planning"* by *Dorothee Honhon* (UT Dallas). >>

>> The second day started with talks on assortment related topics by *Alara Tascioglu* (Koc University) on *"Online product display orientation"*, *Jean-Sebastian Matte* (McGill University, Montréal) on *"Product Variety and customer behavior in online fast fashion"* and *Mert Cetin* on *"Assortment Customization"*. These were followed by different talks related to the effect of pandemics on retail operations by *Marjolein Buisman* (WHU Koblenz) or delivery problems by *Susana Relvas* (University of Lisbon). Finally, the conference was comprehended with a series of short presentations to discuss early research ideas. The full program can be found here: https://kumpem.ku.edu.tr/en/events/2022-kumpem-forum-retail-conference-industry-day/.

▲ Organizers of meeting *EWG Retail Operations* and members of the EWG (from left to right): *Alexander Hübner* (TU Munich), *Meltem Kayhan* (Koc University, Istanbul), *Victor Martinez de Albeniz* (IESE Barcelona), *Robert Rooderkerk* (RSM Rotterdam) and *Gürhan Kök* (Koc University, Istanbul).

The conference was accomplished with a city tour through the historical Istanbul. This year participants were also welcomed to take part in the *11th KUMPEM Retail Conference Industry Day* at October 14th. The *KUMPEM - Koc University Retail Research Forum* aims to foster and strengthen research-industry collaboration in Turkey since 1999 and is sponsored by *Migros*, a pioneering supermarket chain in Türkiye (https://kumpem.ku.edu.tr/en/).

▲ Meeting *EWG Retail Operations*: the traditional "family photo".

The working group will organize the next meeting in September 21-22, 2023, in Stockholm, Sweden. This will be accomplished with a *PhD Summer School on Retail Operations and Analytics* from September 18-20, 2023, also in Stockholm. Details can be found here: http://www.ewg-retail-ops.eu.

THE 2022 SBPO IN JUIZ DE FORA MARKS RETURNING TO IN-PERSON ANNUAL MEETINGS!

Simone Martins <simone@ic.uff.br>

After two editions happening remotely in 2020 and 2021, the *54th Brazilian Symposium on Operations Research* (*SBPO 2022*) took place in-person from November 8 to 11, 2022 (https://sbpo2022.galoa.com.br/).

The *SBPO* is an annual event organized by the *Brazilian Society of Operational Research* (*SOBRAPO*) to promote the academic-scientific communities' meeting with professionals interested in the most diverse areas of *OR* performance.

In 2022, it was organized by the Federal University of Juiz de Fora (UFJF) and the Federal University of São João del Rei (UFSJ). Several sponsors supported the event: Capes, CNPq, Eletrobras, Accenture, Cemig, MRS, Genoa, Casnav and Bauducco.

The official theme of this edition was *"The role of the OR in the Energy Transition"* and there were 84 technical sessions with oral presentations and posters, totalizing 336 papers. Also, six plenaries and three short courses on various actual *OR* topics were presented.

The president of *SOBRAPO*, *Professor Caroline Mota*, opened the event with the rector of UFJF, *Professor Marcus Vinicius David*, the director of the Engineering School of UFJF, *Henrique Antônio Carvalho Braga*, the Local Coordinator and the Coordinator of the Scientific Committee of the *54th SBPO*, *Professor André Marcato* and *Professor Luiz Satoru Ochi*, respectively.

In 2022, *SOBRAPO* created the fellow prize, and the first to receive it was *Prof. Nelson Maculan Filho*, who opened the *SBPO* with the lecture *"On Operational Research in a Pandemic Time"*.

Moreover, five plenaries happened during the event. *Professor Laura Albert*, Chair of David Gustafson Department of Industrial & Systems Engineering at the University of Wisconsin-Madison, discussed advancing the future of *Operational Research*.

Dr. Jeffrey English is a lead operations research scientist at Fujitsu Intelligence Technology in Vancouver. He introduced Fujitsu's Digital Annealer, a quantum-inspired architecture to solve combinatorial optimization problems in their quadratic unconstrained binary optimization (QUBO) form.

Dr. Welington Luis de Oliveira is currently an Associate Professor at the Center of Applied Mathematics of Mines Paris, Université PSL. He discussed probability functions in optimization models for energy management under uncertainty.

Dr. Rosiane de Freitas is an Associate Professor at the Institute of Computing of the Federal University of Amazonas, Brazil. She presented special graph colorings and polyhedral combinatorics for MILP formulations to solve channel assignment problems in artificial/ real-world mobile wireless networks.

Dr. Andre Luiz Diniz, project manager of the Electrical Systems Department (DSE) of the Electrical Energy Research Center (CEPEL), discussed recent challenges for energy planning such as intermittent renewable sources, demand response, reversible plants, and energy storage.

Also, three small-term courses happened for the participants of *SBPO* about interactive dashboards, decision-making in complex scenarios, and machine teaching.

The *SOBRAPO* awarded the best paper written in English presented at the Symposium. The *54th SBPO* also awarded prizes for the *best Scientific Initiation Work Report*, *best PhD Thesis* and *best MSc Dissertation*. Amongst the rewards, the winners received a laptop (offered by our sponsor *CASNAV*), as an incentive for young researchers interested in *Operational Research*.

▲ *The opening session of the SBPO 2022* (professors from left to right): *Luiz Satoru Ochi, Henrique Antônio Carvalho Braga, Marcus Vinicius David, Caroline Mota,* and *André Marcato.*

▲ *SBPO 2022*: *Prof. Nelson Maculan* received the first *Fellow Prize* from *SOBRAPO*.

▲ *SBPO 2022*: *Remote plenary* by *Prof. Laura Albert.*

▲ *SBPO 2022*: *Dr. Jeffrey English* talking about *Fujitsu´s Digital Annealer* (left), and *Prof. Welington Luis de Oliveira* (right) about *optimization models for energy management under uncertainty.*

▲ *SBPO 2022*: *Plenaries* by *Prof. Rosiane de Freitas* (left) and *Dr. Andre Luiz Diniz* (right).

▲ Attendees gathered in Juiz de Fora for the *SBPO 2022*.

▲ *Confraternization dinner* at *SBPO 2022*.

This edition created two enterprise challenges in themes of Energy and Logistics, offered by our sponsors *Eletrobras/CEPEL* and *MRS*, which also received prizes.

There was a delicious *confraternization dinner* where the prizes were announced.

It was wonderful to have 455 registered for this in-person event since 2019. We hope to meet again next year in *SBPO 2023*, which will happen from 6 to November 10, 2023, in Parque Tecnológico São José dos Campos, São Paulo.

Cordially thanks to dear *Prof. Dr. Antonio Mauttone* for communication to make this report possible.

- G.-W. Weber

OR AT SIMANTAP 2022 IN PARAPAT, INDONESIA: MATHEMATICALLY STRONG, ARTIFICIALLY ROBUST

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SIMANTAP 13th 2022 was an international and national conference for sharing knowledge and research in Mathematics, and its applications provided a platform for teachers, researchers and practitioners from both academia as well as industry to meet and share the cutting-edge development of mathematics, and educational mathematics based research. In the *13th SIMANTAP*, the topic chosen was *"Mathematically Strong, Artificially Robust"*, dedicated to a motto from *Operational Research* (*OR*).

▲ *SIMANTAP 2022*: *Opening words: Dr. Ahmad Ridwansyah Putra,* and *Poster*.

The conference took place at *Hotel Patra Comfort Parapat*, in Parapat, North Sumatra, Indonesia, near *Lake Toba* with a very beautiful view. It was collaboration between *STIKOM Tunas Bangsa Pematang Siantar* and *IndoMS SUMUT-ACEH* along with *BSI Jakarta University, Potensi Utama University, STMIK Kaputama*, Indonesia, on November 28-29, 2022. Due to the COVID-19 pandemic, the conference was mainly held online using ZOOM and Direct. This event was the 13th conference in this still novel conference series. Its topic *"Mathematically Strong, Artificially Robust"* is of a vast importance worldwide, especially, for an emerging nation like Indonesia with its many young enthusiastic people. This conference aimed *i.*) to bring together the scientists, engineers, researchers, practitioners, academicians, and representatives of civil society organizations within a scientific forum; *ii.*) to share and to discuss theoretical and practical *OR* knowledge about innovation in applied mathematics, statistics and mathematics education. This congress was especially used as a scientific stage for accommodating exchange between young researchers who mostly originated from Indonesia in the areas of applied mathematics. Hence, a number of the invited speakers and many of the regular participants at this conference were young promising investigators who are now becoming well known more and more, and reputable worldwide. Indeed, at *SIMANTAP 2022*, *OR* as well as mathematics applied as our valuable relay to the real life with all of its industrial and economic, environmental and social, developmental and educational challenges, and as a precious chance for the young scientists to get further involved within contemporary, state-of-the-art research and the international *OR* family.

The *keynote talks* focused especially on the *OR*, Applied Mathematics and Data Science. They discussed main areas of latest *OR*, mathematical analysis and applied mathematical issues and developments, for example, in Optimization, Computing, Complexity Theory, Theoretical Foundations, Uncertainty Modeling and Management, Analytics, Artificial Intelligence, Education, *OR* for Development and Developing Countries, and - with a future promise to *OR* applications.

There were six keynote speakers of the conference: *Prof. Dr. Dorien De Tombe* (from the Netherlands): *"Knowledge institutes for Complexity for handling pandemics"* with the moderator General Secretary of North Sumatra APTIKOM, *Dr. Muhammad Iqbal*; *Prof. Dr. Gerhard Wilhelm Weber* (from Poland, Germany and Türkiye): *"The Kerkenes Eco-Center Project OR Meets Archeology, Architecture and Engineering for Science and the Improvement of Living Conditions in Rural Anatolia"*; *Prof. Dr. Masaji Watanabe* (from Japan): *"Development of techniques for measurement and analysis of underwater topographic change"*; *Prof. Dr. Abdel Salhi* (from the UK): *"A New Approach to Protecting Data Privacy in the Age of Data"*; *Dr. Dedy Hartama*, ST, M. Kom (STIKOM Tunas Bangsa): *"Model of IOT-Based Waste Handling Towards Smart City in Pematang Siantar City"*; *Dr. Syahril Efendi*, S.Sc., MIT (North Sumatra University): *"The DEA model with the CCR method in determining data centers and the number of clusters based on efficiency references"*.

▲ *SIMANTAP 2022*: keynote speakers (online) L-R: *Prof. Dr. Gerhard-Wilhelm Weber*, *Prof. Dr. Masaji Watanabe*, *Prof. Dr. Abdel Salhi*.

▲ *SIMANTAP 2022: keynote speaker Prof. Dr. Dorien De Tombe.*

▲ *SIMANTAP 2022: birthday celebration for Prof. Dr. Herman Mawengkang.*

SIMANTAP 2022 became a hugely successful event, attracting researchers from many regions in Indonesia and providing an extraordinary academic experience for the participants. Attended by 220 offline participants and 1200 participants through ZOOM, more than 120 titles accepted to be presented at *SIMANTAP 2022*.

The conference organizers and many of the participants have a long and cordially friendship within *IFORS* and *EURO*, especially, at their conferences with streams and sessions. In reverse, many of our *EURO* and *IFORS* friends have been invited to North Sumatra, to the city of Medan and to nearby Lake Toba, and received hospitality in recent ten years. During the conference, *Prof. Gerhard-Wilhelm Weber* kindly invited to the next conference highlights of *IFORS 2023* Santiago, Chile, and *EURO 2024* Copenhagen, Denmark.

▲ *Lake Toba*, landscape of *SIMANTAP 2022* (Photo: courtesy of *Mr. Yudha Pratama Saragih*).

During *SIMANTAP 13th 2022* at the beautiful Hotel Patra Comfort Parapat, at Lake Toba, the world-famous pearl of Sumatra, the 76th birthday of *"Professor Herman"* was cheerfully and solemnly celebrated in great friendship and warmth which are so characteristic for our Indonesian and international *OR* families. *SIMANTAP 2022* was officially opened by the Chairman of the Foundation, *Prof. Dr. Ahmad Ridwansyah Putra*, on November 28, 2022.

As the *Editor in Chief* of the conference, we would like to extend my deepest appreciation to all local organizers who worked very hard and showed a great care and warmth, to all the keynote speakers, participants and all the many friends from near and far. Without their support this conference was not a success. Finally, I wish you all a great success in the years to come.

XVIII SUMMER SCHOOL IN DISCRETE MATHEMATICS CELEBRATED IN BEAUTIFUL VALPARAÍSO, CHILE

Martín Matamala <mar.mat.vas@dim.uchile.cl>, **Pedro Montealegre** <p.montealegre@uai.cl>
Dana Pizarro <dana.pizarro@uoh.cl>, **Martín Ríos-Wilson** <martin.rios@uai.cl>, **Víctor Verdugo** <victor.verdugo@uoh.cl>

The *Summer School on Discrete Mathematics* has taken place every year since 2006 at the Institute of Complex Systems in Valparaíso, Chile. It has been a cornerstone event in the Chilean community related to Discrete Mathematics, bringing together students and researchers of Combinatorics, Computer Science, Graph Theory, Algorithmic Game Theory, Optimization, Operations Research, and related areas. Every year the school receives about 40 advanced undergraduate and graduate students, most of them from Chile, Latin America, Europe, and the USA. Being an event with a long tradition, we can feel the impact that the school had in creating an Algorithms and Combinatorics community in Chile. Just as an example, many of the current organizers participated in the school as undergraduate students and were attracted to the area; now we are part of the organizing committee as faculty in different Chilean universities.

Valparaiso is a colorful and lively port city with great scenery and cafes with stunning views of the ocean. The beautiful location helps to attract people, from great speakers to young students. Over the years, we were honored to host world-renowned experts giving lectures on different key topics.

The last two versions of the school, in 2021 and 2022, confronted the challenge of the COVID pandemic, which made us hold the school online via the *Gather* platform. This is an online space that allows participants to move around in a virtual world, interacting with people and objects in their vicinity. Despite the difficulties, the events were very successful, having a large number of students and researchers connecting from many different places in the world.

▲ View from *"Cerro Artilleria"* to the port of Valparaiso. Picture from https://chile.travel/.

For the 2023 version, we were very happy to host the school in person again. We received 43 undergrad and graduate students, and we were fortunate to have three wonderful courses by top-notch speakers:

Each course consisted of four lectures and an assignment sheet was given after each lecture for the students to solve. Time was given for the students to collaborate and solve the exercises in several rooms existing in the school venue. *Marthe* provided a tour of structural results and efficient algorithms for studying the chromatic number in graphs in certain specific graph classes, such as perfect graphs or planar graphs, and how the chromatic number can be tied to other graph parameters. In his course, *Vincent* presented algorithms with provable guarantees for several data mining and machine learning tools that are at the heart of a large number of computer science applications in both academic and industrial worlds, including clustering and differential privacy. *László* gave an overview of classical and recent results and techniques for strongly polynomial computability, in particular, focused on linear programming, network flows, proximity results, as well as a special class of combinatorial interior point methods.

Marthe Bonamy,
CNRS and LaBRI, Bordeaux:
"Graphs with high chromatic number"

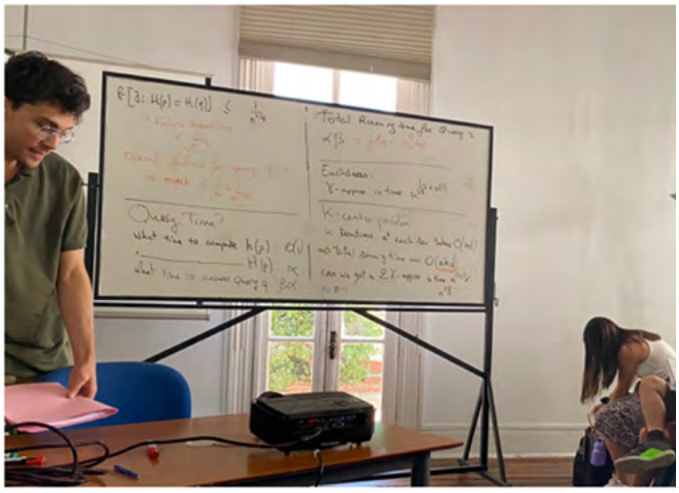
Vincent Cohen-Addad,
Google Research:
"Provable algorithms for data mining and machine learning"

László Végh,
London School of Economics:
"Linear programming: the quest for strongly polynomial algorithms"

▲ *László* giving a lecture on *interior point methods*.

The summer school had about 60 participants, including students and researchers, and attendance was high throughout the week. The participants were very enthusiastic, asked many questions, and participated in most of the activities. At the end of the week, the organizers gave out *prizes* to the *best handed-in homework*. The winners were *Benjamín Rubio* (Pontificia U. Católica) and *Federica Cecchetto* (ETH Zurich), who got books related to the topics of the school. We highlight that Federica got the prize in two of the three courses.

▲ *Marthe* giving a lecture on graphs with *high chromatic number*.



▲ *Vincent* giving a lecture on *hashing*.

▲ From left to right: *Benjamín Rubio, Pedro Montealegre, Marthe Bonamy, Antonia Labarca,* and *Federica Cecchetto.*

▲ *Summer School in Discrete Mathematics 2023*: the always popular group picture.

▲ From left to right: *László Végh, Federica Cecchetto, and Arturo Merino.*

This year's organizing committee consisted of a team from three different Chilean universities: *Martín Matamala* (U. Chile & CMM), *Pedro Montealegre* (Chair, U. Adolfo Ibañez & CMM), *Dana Pizarro* (U. O'Higgins), *Martín Ríos-Wilson* (U. Adolfo Ibañez), and *Victor Verdugo* (U. O'Higgins). We would like to thank the *Center for Mathematical Modelling* (*CMM*) for providing generous funds for the school's organization.

Further information on the summer school and its previous versions can be found on the school's webpage: https://eventos.cmm.uchile.cl/discretas2023/.

NEWS FROM THE EURO WISDOM FORUM: AUTUMN/WINTER EVENTS 2022

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Annunziata Esposito Amideo <annunziata.espositoamideo@ucd.ie>**, Paula Carroll** <paula.carroll@ucd.ie>

The *EURO WISDOM* Forum (*Women In Society: Doing Operational Research and Management Science*) was launched three years ago, in January 2020, and since that time it is actively working on promoting gender equality in *OR*.

Here, the members of the *WISDOM* board present the most important events organized by *WISDOM* during the second semester of 2022.

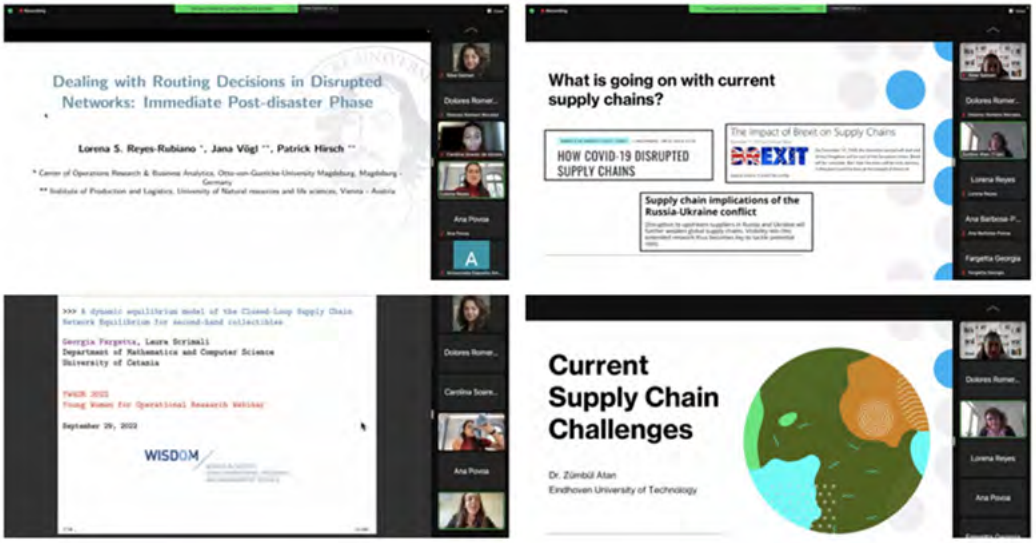
EURO WISDOM Webinars

The main purpose of the *WISDOM virtual webinars* is to present to the *OR* community the work of the awardees of the *WISDOM Young Women for OR initiative* (*YW4OR*) and to use these thematic meetings to discuss the state of research in relevant areas of *OR*. As a rule, webinars are held via Zoom, and a subject matter expert is invited to comment on the *YW4OR* presentations and reflect on potential future research directions. Webinars are planned by the Events subcommittee under the guidance of the *WISDOM* chairs.

It has already become a tradition to also hold a *Winter virtual webinar* in December where the *WISDOM* members report on the annual work of the Forum, its results and challenges, announce the next *YW4OR* cohort and exchange New Year's wishes.

EURO WISDOM Webinar on Production and Logistics

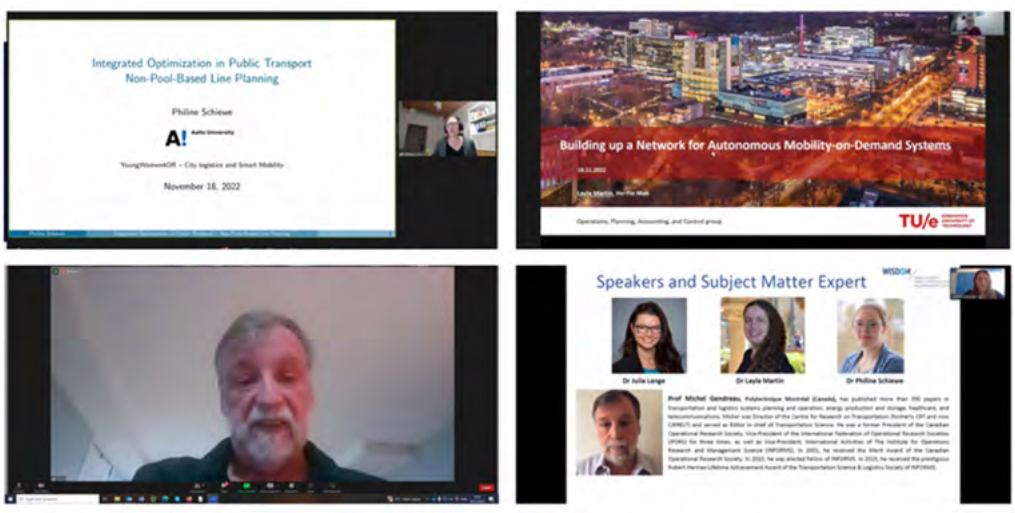
On 29th of September 2022, EURO *WISDOM* held a *YW4OR Webinar* on Productions Logistics moderated by *Prof Sibel Salman*, Koç University, Türkiye, with subject matter expert *Dr Zümbül Atan*, Eindhoven University of Technology, Netherlands who spoke about meeting the challenges in this area, and synergies of the *YW4OR* topics with existing work. The *YW4OR* talks were: *"A two-phase methodology to solve a Sensor Placement Problem in Waste Management based on a Vehicle Routing Problem with Detours"* by *Dr Carolina Soares de Morais*, *"An on-line algorithm for routing an unmanned aerial vehicle for road network exploration operations after disasters under different refueling strategies"* by *Dr Lorena Silvana Reyes-Rubiano*, and *"A sustainable dynamic closed-loop supply chain network equilibrium for collectibles markets"* by *Dr Georgia Fargetta*.



▲ A screenshot from the *WISDOM Webinar* on *City Logistics / Mobility*.

EURO WISDOM Webinar on City Logistics and Mobility

On November 18, 2022, *WISDOM* held a *YW4OR webinar* on *"City Logistics and Mobility"*. The webinar was moderated by the Chair of the *WISDOM* Events subcommittee, *Prof. Renata Mansini*. Three 10-minute talks were presented by *YW4OR* 2021 awardees: *"Planning scheduled services in multimodal synchronized city logistics systems"* by *Dr Julia Lange*; *"Building up a network for autonomous mobility-on-demand systems"* by *Dr Layla Martin*, and *"Integrated Optimization in Public Transport - Non-Pool-Based Line Planning"* by *Dr Philine Schiewe*. The talks were moderated by the invited expert, *Prof. Michel Gendreau* from the Polytechnical University of Montréal, Canada. At the end, the participants were invited to discuss the challenges and synergies with existing work by participating in a moderated open discussion.



▲ A screenshot from the *WISDOM Webinar* on *City Logistics / Mobility*.

All *WISDOM webinars* are recorded and available on the EURO site https://www.euro-online.org/web/pages/1654/wisdom.

WISDOM Winter event

It is a tradition of the EURO *WISDOM* forum to finalize the year with a Winter event where the participants remind the events of the passing year, discuss their future plans and welcome the new *YoungWomen4OR* awardees.

▲ A screenshot from the *WISDOM Winter event 2022*.

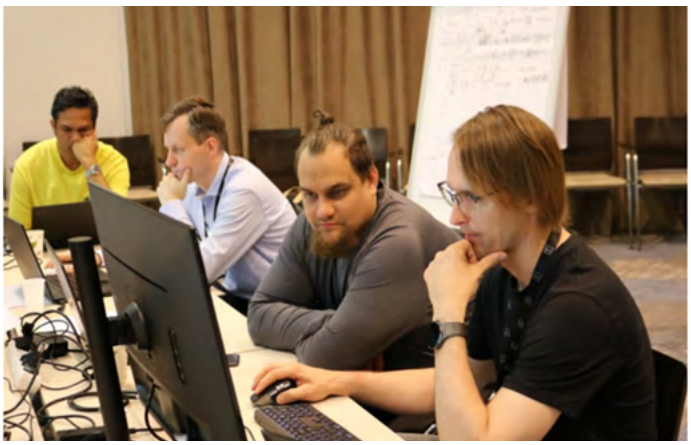
The last *EURO WISDOM Winter event* was successfully organised on the 16th of December 2022. The webinar started with Introductions and a few words about webinar etiquette by *Prof. Dolores Romero Morales*, EURO *WISDOM* Forum Interim Chair. Then, the *WISDOM* activities reporting followed by *Dr Annunziata Esposito Amideo* on behalf of the *WISDOM* Research Subcommittee, *Dr Dilek Günneç* on behalf of the *WISDOM* Events Subcommittee and *Dr Özgen Karaer* on behalf of the *WISDOM* PR Subcommittee. The next on the agenda was a farewell to the *YoungWomen4OR 2021-22* and a welcome speech for the *YoungWomen4OR 2022-23*. Then a few *YW4OR* awardees from previous cohorts gave testimonials on their experiences with their career and professional visibility after winning this award. The event closed with an open discussion and closing remarks by *Prof. Dolores Romero Morales*.

4TH WORKSHOP OF MATHEMATICAL SOLUTIONS IN BUSINESS AND INDUSTRY: OR AND FUN AT THE BALTIC SEA IN PALANGA, LITHUANIA

Gabija Celiešienė <gabija.celiesiene@ktu.lt>, **Audrius Kabašinskas** <audrius.kabasinskas@ktu.lt>

After two years of COVID-19 pandemics break, the *4th Workshop of Mathematical Solutions in Business and Industry* (*WMSBI 2022, https://mathworkshop.ktu.edu/*) finally has been organized June 6-10, 2022, in Palanga. This Lithuanian coastal town is one of the most popular resorts in the country. It is a particularly admired place not only by Lithuanians but also by foreign guests.

For one week, researchers from Lithuanian and foreign universities gathered in a modern conference center in a picturesque resort to solve the problems of one of Lithuania's largest companies. These companies presented problems related to *Operational Research*, logistics, decision-making, risk assessment, and usability studies:



▲ *WMSBI 2022*: busy day with *Green Genius* team.

• The problem presented by *JSC Girteka Logistics* dealt with the influence of oil prices on truck fuel prices in a variety of countries. As one of Lithuania's biggest digital cargo transportation companies, Girteka combines traditional cargo transportation with modern technology. More than 800,000 full loads are delivered each year by Girteka's environmentally friendly fleet of 8,000 trucks.

• As a telecommunications company, *SC Telia* operates not only in Lithuania, but also internationally. Among the tasks they assigned to scientists was to analyze customer behavior, loyalty, and migration between plans.

• Another company that provides challenges is *JSC Green Genius*. Currently, *Green Genius* operates in 12 countries in Europe as part of the *Modus Group*, an international group of companies. There are three main areas of activity for the group: renewable energy (*Green Genius*), mobility services (*CityBee*), and the automotive business. One of their areas of activity is the production of biogas. Hence, there were various challenges related to the collection and delivery of raw materials at multiple production points, as well as issues related to the development of the production network. From an *OR* perspective, these were typical scheduling, logistics, and supply chain design problems.

According to the Dean of the *Faculty of Mathematics and Natural Science at Kaunas University of Technology* (KTU FMNS), *Assoc. Prof. Dr. Bronė Narkevičienė: "Every business enterprise must deal with a wide range of mathematical challenges. Today's decisions can determine the company's future. By prioritizing mathematics, you can be sure that such solutions are superior."* The workshop organizers - mathematicians from *KTU FMNS* - have many years of experience in applying mathematics to finance, insurance, medicine, mechanics, big business data analytics, and other industries and businesses. During the week-long workshop, *OR* scholars and mathematicians searched for solutions to problems presented by companies.

▲ *WMSBI 2022*: Final preparations for reporting on *Girteka* problem.

"We are very glad that the companies which have turned to us have been extremely satisfied with our solutions. We believed that scientific solutions would help us achieve an optimal result when we participated in the workshop. Having seen the actual calculations, we are satisfied that Lithuania has all the conditions for a successful synergy between science and business", says *Arvydas Noreika*, Director of the Department of Biogas Power Plants Raw Materials at *"JSC Green Genius"*. His company aims to reduce CO2 emissions as one of its primary goals. Consequently, the company hopes that the results of successful participation in the mathematical workshop will significantly contribute to the realization of this goal.

During the *WMSBI*s, works begin with brainstorming and analysis of data provided by the companies. Then, at the end of the week, preliminary solutions are provided to the company. On the final day, the scientific leader of a team presents the main results achieved by the group, and the representative from the business world gives a feedback. Overall, the results achieved are more than satisfactory for companies and they usually look forward to continued cooperation.

During the four years of the workshop, many large companies have participated in it, such as the medical spa *"Eglės sanatorija"*, the telecommunication company *Bitė Lithuania*, one of the largest business groups in Lithuania, *"SBA Concern"*, the fintech start-up *"Finpass"*, a leading Nordic financial services group, *"SEB"*, a leading provider of standard and express parcel services, *"DPD"*, a leading global professional services firm, *"AON"*, the *"Callcredit Information Group"*, the global coffee & tea company *"Jacobs Douwe Egberts"*, the car-sharing service company *"CityBee"*, the pharmacy chain *"Gintarinė vaistinė"*, and *"Baltic Mill"*.

The *5th Workshop on Mathematical Solutions in Business and Industry* will be held on June 12-16, 2023, in Palanga. More about our upcoming workshop can be found under https://mathworkshop.ktu.edu/.

▲ Participants of *WMSBI 2022*: in the middle: *Dean of FMNS, Prof. Bronė Narkevičienė*.

THE LONGEST-RUNNING ON-GOING NATIONAL CONFERENCE IN TÜRKIYE: 41ST NATIONAL CONFERENCE ON OR/IE

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After online conferences during the pandemic period, the *41st Congress on Operational Research / Industrial Engineering* (*YAEM2022*) was held face-to-face in Denizli from October 26 to 28, 2022 (www.yaem2022.org). The conference was organized by the *Department of Industrial Engineering, Pamukkale University* (www.pau.edu.tr), jointly with the *Turkish Society for Operational Research* (www.yad.org.tr). *Askiner Güngör* was the president of the conference.

In today's society that generates huge amounts of data, its analysis, interpretation, and optimal decision-making are essential not only in the world of education, scientific research, public statistics, and business but in all areas of life, with the benefits that this entails for society in general. As the problems and decision environments become increasingly complex, it is essential to integrate advanced analytics methods in decision support/making. Many of the *Operational Research* (*OR*) methods and *Industrial Engineering* (*IE*) problems are the foundations of Data Science and Artificial Intelligence algorithms, based on the large amounts of data generated by new technologies. Due to the dynamic structure mentioned above, the main theme of the

▲ *YAEM2022*: *Bahar Yetiş Kara* and *İhsan Sabuncuoğlu*.

conference was determined as *"OR/IE in a Changing World"*. More than ever, this event has been a unique opportunity as a national forum in which academicians, researchers, and practitioners in *OR/IE* met to exchange ideas and knowledge and shared the best practices

▲ *YAEM2022*: A stand-up meeting during the conference.

This conference series is the longest-running and on-going national conference series in Türkiye. After the last two editions held online due to the COVID-19, finally the *41st Congress on OR/IE* (*YAEM2022*) was celebrated face-to-face with an intense participation. The extensive and high-level scientific program brought together more than 400 national participants from the academy and industry, at *Pamukkale University*.

Very relevant professionals from the academic and business fields participated in these round tables.

The four *plenary talks* were focused on *"Industrial Engineering in a Changing World"*, *"Understanding the Importance of Randomness and Data in a Changing World"*, *"Information/ Communication Revolution: Reflections on Education"*, and *"Industrial Engineering in Health Systems Management"*. On the other hand, four courses were organized openly to all participants. The topics of the courses were *"Site Selection and Network design in Humanitarian Logistics"* by *Bahar Yetiş Kara*, *"Operational Research Approaches in Energy Systems"* by *Ayşe Selin Kocaman*, *"Decomposition Approaches in Large Dimensional Optimization Problems"* by *Taghi Khaniyev*, and *"The Role of Operational Research in the European Green Deal"* by *Eren Özceylan*.

In the conference, there were two competitions held. The first one is the *YAEM Student Project competition* that is open to projects carried out by undergraduate students in the fields of *IE* and *OR*. The second competition was organized for the companies operating within the borders of Türkiye. Companies presented the *OR* approaches they applied

▲ *YAEM2022*: Places visited as part of the social program: *Travertines of Pamukkale* and *Laodikeia* ancient city, respectively.

There were four plenary talks with outstanding speakers (*İhsan Sabuncuoğlu, İmdat Kara, İlhan Or,* and *Serpil Erol*) of both national and international reputation. During three days, 200 valuable research studies from 58 different universities, four special sessions, two competitions (one for students and one for practitioners), four courses covering current issues, and social events within the scope of the congress were experienced. The research papers presented in 54 different sessions were both methodological and applied, encompassing all topics related to the *OR/IE* field.

In the parallel sessions, different topics related to scheduling, facility planning, network theory, assembly/disassembly lines, humanitarian logistics, sustainable supply chain, system dynamics, machine learning, game theory, decision support systems, industry 4.0, internet of things, etc., were discussed.

to industrial engineering problems in their organizations. Experienced juries (both academicians and practitioners) in both competitions presented the awards to the winners.

The conference also had an exciting social program with a welcome drink and a concert by the Faculty of Music and Performing Arts; a private visit to the travertines of *Pamukkale* and *Laodikeia* ancient city. The central location of the venue on the Pamukkale University Campus allowed the participants to comfortably enjoy all the attractions and services offered by university and city.

More information and full program at www.yaem2022.org or by contacting the President of the Conference, *Aşkıner Güngör* (askiner@pau.edu.tr).

▲ *YAEM2022*: The *welcome concert* and the *"family photo"* at the *closing ceremony*.

SOCIAL ENTREPRENEURSHIP ACADEMY: OR-BRIDGE FOR THE YOUTH TO GLOBAL SOCIAL VENTURES - ONSITE IN BEAUTIFUL ALANYA, TÜRKIYE

Berat Kjamili <beratkjamili@gmail.com> **Gerhard-Wilhelm Weber** <gerhard.weber@put.poznan.pl>

The aim of the *GLOBUS Social Entrepreneurship Academy* is to spread knowledge about social entrepreneurship and build strong relationships within the field in Türkiye. The academy also strives to encourage young people to become entrepreneurs, with a particular emphasis on including those who may be economically or socially disadvantaged. The second program of the academy took place in Alanya, Türkiye, in November of 2022. In addition to the above, it is worth mentioning that Alanya is a beautiful coastal city in Türkiye, renowned for its stunning beaches, rich history and cultural heritage.

The slow pace of economic growth has resulted in a shortage of employment opportunities for the youth, particularly in countries with a large demographic of young individuals. This presents a pressing issue that demands a solution. As a result, there is an increasing need for the application and dissemination of *Operational Research* methods and results to address this challenge.

Migport (www.migport.org) is an organization that aims to make a positive impact on the world by connecting refugees and locals by anonymized information about skills, needs, and preferences. They also organize conferences to promote the usage of big data in the humanitarian sector and the importance of social entrepreneurship. Additionally, they teach refugees in Türkiye how to become successful social entrepreneurs. One of their programs with the partnership and sponsorship from *The Konrad-Adenauer-Stiftung* (*KAS*) *Türkiye* is *"GLOBUS Social Entrepreneurship Academy"*, helps young people find jobs and start their own ventures. *Migport Social Enterprise* has been a product of "Liberated Social Entrepreneur" mindset which enables social entrepreneurs to bring both for profit and nonprofit structures to increase their impact [1].

The *Konrad-Adenauer-Stiftung* (*KAS*) (www.kas.de) is a German political foundation, which is active in over 120 countries around the world. KAS Türkiye aims at strengthening relations between Türkiye and Germany while promoting political dialogue. It has been a strong supporter of Migport's social enterprise and frequently includes Migport as a best example for refugees in their programs.

The *GLOBUS Social Entrepreneurship Academy Conference* is a four-day *certificate program* for Turkish youth entrepreneurs. The program includes mentorship, workshops, training, and networking opportunities to help participants develop social enterprise startup ideas, learn about social entrepreneurship, and pitch their work to different stakeholders. The goal of the program is to reach and encourage potential entrepreneurs, with a focus on women and youth. During the four days, participants will receive 9 hours of social entrepreneurship training, 3 hours of mentorship, 1 hour of NGOs discussion, and multiple networking opportunities. They will also have the chance to present their ideas at a networking and closing ceremony. The goal of the *GLOBUS Social Entrepreneurship Academy* is to reach and encourage potential entrepreneurs, with a special focus on women and youth. The program is designed to promote socio-economic inclusion and help young people build sustainable businesses that address the challenges facing their communities. By leveraging operational research methods and results, the program equips participants with the skills, knowledge, and resources they need to succeed in the world of social entrepreneurship.

Social Entrepreneurship Academy aims to bring attention to the importance of social entrepreneurship in Türkiye, as well as enhance partnerships within the field. >>

>> By promoting a comprehensive and inclusive approach to entrepreneurship, the academy hopes to improve socio-economic opportunities for young people. The latest program was hosted in Alanya, Türkiye, in November 2022. To bring a new perspective, one could add how operational research methods can be applied to optimize and improve the program's approach to fostering social entrepreneurship, as well as its overall impact.

The GLOBUS program, which means "globe" in German, is designed to serve the purposes of raising awareness, promoting socio-economic inclusion, and supporting entrepreneurship. It focuses on ideas related to "Diversity & Inclusion" and aims to bring together around 20 social entrepreneurs aged between 18 to 40 years old from all over Türkiye. The program is open to everyone residing in Türkiye, including active entrepreneurs, university students, women interested in social entrepreneurship, and stakeholders who generate national or international values. The program covers topics related to social entrepreneurship, and participants will learn and discuss social entrepreneurship concepts and business models that shape the future of social entrepreneurship.

The GLOBUS program brings together young social entrepreneurs and mentors from Türkiye to examine and assess early and middle-stage social entrepreneurial ventures. The program provides participants with enhanced skills to further develop their ventures, including advice on ways to gain access to investment funds. It aims to promote social entrepreneurship among young people in Türkiye and has a focus on sustainability. The program is fully financed by the *Konrad*-Adenauer-Stiftung (KAS) Türkiye.

The GLOBUS Team consists of *KAS Türkiye* and *Migport*. KAS Türkiye is represented by KAS Türkiye Director, *Walter Glos*, KAS Türkiye Project Coordinator, *Anastasia Pazer Ilgaz*, and KAS Türkiye Social Media Coordinator, *Güzide Doğan*. In addition, Migport is represented by GLOBUS Director and Migport Founder, *Berat Kjamili*, Migport Associate Coordinator, *Sedef Kjamili*, and Migport Advisor, *Prof. Dr. Gerhard Wilhelm Weber*. The respectful trainers and mentors are as follows: *Prof. Dr. Adil Oran*, *Dr. Basak Kale*, *Berat Kjamili*, *Derya Baykal*, *Dr. Fatih Balci*, *Dr. Gülru Bayraktar*, *Dr. Hakan Gülerce*, and *Dr. Zeynep Erden Bayazit*. GLOBUS initiative has been a proud partner of the *Operational Research* community, including EURO, IFORS and INFORMS, for many years.

In many "developing countries", social entrepreneurship is relatively uncommon. However, the concept of a "LiBerated Social Entrepreneur" presents a new approach where social businesses should be sustainable [1]. This concept, specifically for developing and emerging countries, combines the use of business metrics to sustain social impact. That approach differs from traditional commercial entrepreneurship, which initially focuses on individual metrics such as profit, sales, and ROI. Instead, social entrepreneurs also aim to generate a social return from the outset.

The authors incorporate various *OR* methods in their business plan, including the use of theories such as Game theory, Max-Flow - Min-Cut theorems, *Joseph Schumpeter*'s creative destruction theory, and *Adam Smith*'s diversification model. They also utilize advanced data analytics tools such as Multivariate Adaptive Regression Splines (MARS), Conic MARS (CMARS), and their robust versions, RMARS and RCMARS, to support their projects. *Migport* is one example of this approach, a mobile application that serves as a *"refugee portal"* and is supported by refugee big-data analytics. The business model is built on the idea of a liberated social entrepreneur and provides guidance to enable social entrepreneurs to behave like *commercial* entrepreneurs while still acting as "LiBerated Social Entrepreneurs" [2]. *Berat Kjamili* also started the digital residence permit appointment system *"e-residency"* in Türkiye which has been used by over 10 million foreigners so far.

In conclusion, we submit the concept of *LiBerated Social Entrepreneur* as a new approach to social entrepreneurship in developing countries, which focuses on sustainability and business metrics. We also mention the use of advanced data analytics tools and provide examples of their approach in practice such as Migport and e-residency [3].

A recent news: Since the catastrophic earthquake in south-eastern Türkiye and northern Syria, *Migport* has been committed to helping survivors.

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EUROPEAN WORKSHOP ON EFFICIENCY AND PRODUCTIVITY ANALYSIS – EWEPA 2022 CELEBRATED IN BEAUTIFUL PORTO AND EWEPA 2024 CELEBRATED IN SHINING ALGARVE

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For the 17th time several researchers on the efficiency and productivity analysis field joined together in their biannual European conference that this time took place in Porto, Portugal. *EWEPA XVII* continued a successful path of Efficiency and Productivity Analysis Workshops, that started in Louvain-la-Neuve, Belgium, in 1989 and moved along Europe up to the multicultural city of London in the 2017 and 2019 editions, and to Porto in its last edition (2022). In 2024 the conference will continue in Portugal and will happen in the University of Algarve in Faro.

▲ Dining room at *caves Ferreira*.

EWEPA is the leading biannual conference devoted to the methodology and application of productivity, efficiency and performance analysis of firms, public services, and industries, joining academics and practitioners from all continents. The event includes plenary sessions, regular parallel sessions, thematic parallel sessions, and special sessions for PhD students whose papers are discussed by senior researchers.

Plenary sessions in Porto counted with renowned scientists of the field, in concrete *Peter Bogetoft* from Copenhagen Business School, Denmark, whose keynote was on "*New insights into contract design based on DEA and SFA*", and Victor Podinovski from Loughborough University, UK delivering a talk on "*Modelling VRS and CRS production technologies with component processes*". In addition to these two plenaries, and following a tradition that started in the EWEPAs in London, the community praises the work of prominent scientists in the area. In London 2017 *Peter Schmidt* received the 'lifetime achievement award' and in London 2019 *Knox Lovell* received this achievement. In EWEPA in Porto we honoured *Rolf Färe* and *Shawna Grosskopf*. The third plenary was a contributed session in their honour. In this session, four researchers presented their own work mentioning the importance of the contributions of the two researchers honoured in various fields. *Paul Wilson* and *Leopold Simar* presented the work "*Inference for Productivity Change and Its Sources: Revisiting FGNZ (AER, 1994) Using Modern Tools.*", *Valentin Zelenyuk* presented the paper "*Malmquist Productivity Indexes: A Retrospective and Some Future Perspectives*", *Bob Chambers* presented the paper on "*Path-based Set Representations*", and *Maria Silva* and *Antonio Peyrache* presented the paper on "*Considerations on Network Data Envelopment Analysis and the work of Rolf Fare and Shawna Grosskopf*".

In addition to the above, there were two PhD Discussion sessions with 3 papers each, two special sessions with water and energy regulators (two special sessions organized by *Srini Parthasarathy* from Oxera, UK), and one special session organized by *Subal Kumbakar*, University of Stavanger, Norway, for presenting the book "*Neoclassical Production Economics and Foundations of Efficiency Analysis*".

▲ *Casa do Ribeirinho*, in *Matosinhos City*.

▲ Countries of Origin of *EWEPA XVII* participants.

Overall, the conference counted with 240 participants and around 170 presentations from several countries. European countries and the United States were the countries more most represented in the conference, with a total of 196 participants from Europe, 30 from the American continent, and 5 from Australia.. Asia and Africa were the least represented continents, with just 3 participants overall.

The topics addressed varied from methodological advancements in efficiency and productivity analysis, both in its parametric and non-parametric set of models, and on various applications, including agriculture, banking, education, health and also more trendy topics such as environmental efficiency or sustainability and eco-efficiency applications.

The two social events happened in *Casa do Ribeirinho* in Matosinhos and in *Caves Ferreira* in Gaia, a Port wine cellar.

EWEPA 2024 will happen in the city of Faro, in the Algarve, 18-21 of June 2024. It will have a pre-conference day (on the 18th June) for PhD students presentations, followed by days of plenaries and parallel sessions.

EWEPA Algarve 2024

▲ View of *Faro City*, in the *Algarve*.

▲ The *Gambelas Campus* of *University of Algarve*.

▲ *Faculty of Economics of University of Algarve.*

IORMS CONFERENCE 2023, NIGERIANS READY FOR THE NEWEST OR COMMUNITY IN LASUSTECH

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The *Institute of Operations Research and Management Science of Nigeria* (*IORMS*) was officially commissioned in November 2015 and has been acting as the regulatory body for *Operations Research and Management Science* (*ORMS*) practice in Nigeria. The last physical conference of *IORMS* was held at *Mountain Top University* (*MTU*) in 2019. In 2021, the *IORMS post-COVID-19* conference was held online. It was decided by the *Governing Council* (*GC*) after considering many factors that the next physical conference be held in Lagos, the economic capital of Nigeria, and *Lagos State University of Science and Technology* (*LASUSTECH*) was selected as the conference venue for the 2023 conference. *IORMS Governing Council* (*GC*) and *IORMS National Organizing Committee* (*NOC*) held their first visit/meeting with the *Acting Vice Chancellor* (*AVC*) *Dr. Olaleye Nurudeen* and the management of *LASUSTECH* on 31st August 2022. The *AVC* welcomed the *IORMS GC*. He explained the *Mission* and *Vision* statements of the university, and its history and listed the core values of *LASUSTECH* as Professionalism, Excellence, Commitment, Loyalty, Integrity, Effective Communication, Fairness and Equity, Knowledge Sharing, Respect for the Rule of Law, Transparency, Innovation, and Entrepreneurship. The *IORMS President Prof Rasheed Ojikutu* gave a short talk on the role of *Operations Research* (*OR*) in assisting the university in achieving both the core values and vision. He said *OR* has dependable tools for system development and improvement. He informed the management of the university about the planned *IORMS conference 2023* with the theme: *OR* the science of Economic recovery, sustainability, and control. The chairman of the *IORMS* conference 2023, *Dr. Olabode Adewoye* stated that the conference seeks to bring together *OR* researchers, academicians, and practitioners, whose collective works have sustained *OR* contribution to decision–making and whose current work is expected to play an important role in surmounting challenges in developing countries of which Nigeria is one. He stated further that the conference topics include but are not limited to Economic modeling, Financial engineering, Supply chain management, Artificial intelligence, Soft *OR*, Dynamical systems, Deep learning, Logistics and distribution, Energy, and *OR* in education.

▲ Pro-Chancellor and pioneer Senate members at the inauguration ceremony of *LASUSTECH.*

The collaboration effort initially sought between *IORMS and LASUSTECH* by the *Acting Vice-Chancellor* for the hosting of the *IORMS Conference 2023* was continued by the *New VC, Prof Olumuyiwa Odusanya, and the University Management Team* (*UMT*). The *UMT* held another meeting with the *IORMS-GC* on Tuesday, 24th January 2023 to approve tentatively September 5th - 9th, 2023 for the IORMS Conference 2023. *Prof Olumuyiwa Asaolu* the *IORMS 1st Vice President* represented the *IORMS President Prof R. Ojikutu*. He thanked the *VC* and the *UMT* for the warm welcome. He further echoed the *IORMS Conference 2023* theme and, sub- themes. *Prof. O. Asaolu* said *OR* has a lot to deliver in the area of optimizing resources for maximum productivity in general and particularly in *LASUSTECH* which has just transformed into a University. *Prof Ogunwolu*, a *System Engineering* expert at the University of Lagos, explains the importance of having an *IORMS* presence in *LASUSTECH*. He retreated that *IORMS* will enhance the professional development of both the academic and non-academic staff of the university. *Dr. Olabode Adewoye, the Secretary General of IORMS* presented a summary of the benefit associated with *OR*; *OR* networking through the many conferences, and workshops by *IFORS, EURO, EWG ORD, EUROPT, EWG POR,* etc. He said *Operational Research* provides a well-articulated platform in the form of techniques and models for making optimum decisions tailored toward greater development. The *VC* on behalf of the *LASUSTECH* management team appreciated the visit and the presentation. He added that despite being a medical doctor, he has some residual knowledge of the importance of the *OR*. He promised to give maximum support within his purview to the promotion of *OR* on campus and the *IORMS Conference 2023*. He immediately directed the *University Public Relations Officer* (*PRO*) *Mr. Kuye* to fix a meeting with the *IORMS LOC* so that the *LASUSTECH* local *OR Base* can be created. In the word of the *VC*, a strong local *OR Base* in *LASUSTECH* will assist in the success of the *IORMS Conference 2023*.

▲ *IORMS-GC* first meeting with the *AVC* and *LASUSTECH* management team.

LASUSTECH is the newest university in Nigeria and was established by a Bill signed to law by the *Governor of Lagos State, Dr. Babajide Sanwo-Olu* on the 2nd February 2022. The history of the Institution dates back 45 years ago; starting as *Lagos State College of Science and Technology* (*LACOSTEC*) established in 1978 with retroactive effect from June 1, 1977. In 1988, after 10 years of existence, the *Lagos State Government* changed the name of the Institution from LACOSTEC to *Lagos State Polytechnic* (*LASPOTECH*).

Consequent to the signing of the new Bill, the *Executive Secretary of the National University Commission* (*NUC*), *Professor Abubakar Rasheed* officially presented the certificate of the University to the *Governor of Lagos State, Dr. Babajide Sanwo-Olu* at the *NUC Secretariat*, *Abuja* on Tuesday, 8th February 2022. The University Motto is: For Learning and service; the vision statement is: To be a center of excellence in the provision of scientific and technological education for the sustainable development of the human capital for the development of the local and national economy. The mission statement is to develop and deploy outcomes-based curricula in science and technology to produce highly skilled human resources for self-defense and sustainable development.

▲ The *VC* at the center, *IORMS* at the *LHS; UMT* at *RHS*.

▲ Members of the Senate at the Inauguration ceremony.

The Governing Council of the University (*GCU*) held the first meeting with the *Acting Vice Chancellor* (*AVC*), *Dr. Nurudeen Olaleye* on Monday, 25th April 2022. The *NUC* conducted a series of resource verification visits to the University in September 2022. Thus, The University got the approval to commence 37 academic programs in its five (5) Colleges listed below:

College of Agriculture; college of engineering technology; college of environmental design; college of basic sciences; and college of applied social sciences.

Prof. Olumuyiwa Odusanya was appointed on the 29th of September 2022 as substantive Vice-Chancellor for *LASUSTECH by the State Governor. Prof. O. Odusanya* held his maiden town hall meeting with members of staff of the University on Wednesday, 7th December 2022, and he enumerated the focus of his administration. The focus is on six (6) strategic initiatives with the acronym *IMPACT* which are:

Infrastructural development across the three campuses; Manpower development; Prosperity and property of both staff and students; A strong University culture of academic excellence, discipline, transparency, and best practice; Catalyst to the Lagos State agenda; Town and gown partnership in the context of the entrepreneurial university.

The University inaugurated its Senate on Friday, October 14, 2022. The Senate has engaged in several meetings to consider its academic calendar, and conditions of service amongst other issues. The *2023/2024 Academic Session* admission exercise for pioneer students of the University was conducted. A total number of 1,850 students were admitted as approved by the *National Universities Commission*. The University organized an orientation program for its pioneer students on Friday, 20th January 2023. The Vice-Chancellor held a national press conference to intimate the nation about the university and his plans to take the Institution to a higher level. Furthermore, the *Tertiary Education Trust Fund* (*TETFund*) team visited the University on the 11th of January 2023 for an inspection of the Institution and its existing facilities. For more on *IORMS* see www.iorms.org.ng. Check: info@lasustech.edu.ng for additional information on *LASUSTECH*.

OPTIMISATION, METRIC BOUNDS, APPROXIMATION, TRANSVERSALITY: WORKSHOP WOMBAT 2022 IN BEAUTIFUL PERTH, AUSTRALIA

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The *7th Workshop on Optimization, Metric Bounds, Approximation and Transversality* (*WOMBAT 2022*) was held 13–15 December 2022 in Perth, Western Australia, in tandem with an industry-focused day on 16 December. This joint event was hosted at *Curtin University* by the newly established *Curtin Centre for Optimization and Decision Science*.

This is the first *WOMBAT* in-person event after the COVID pandemic, and the first time *WOMBAT* has come to Perth. Following *WOMBAT*, Curtin Centre for Optimisation and Decision Science, in collaboration with *ARC Training Centre for Transforming Maintenance through Data Science*, hosted a special day focused on the applications of optimization on planning and scheduling maintenance in the resource industry. In the first three days of the workshop, there were 30 participants (inter-state and international) with 20 talks and three plenaries. Special thanks to our keynote speakers *Professor Warren Hare* (University of British Columbia Okanagan), *Adjunct Professor Natashia Boland* (Curtin University), and *Professor Peter Stuckey* (Monash University).

▲ The iconic *WOMBAT* has been with the Australian Variational Analysis and Optimization community for 7 years.

▲ *WOMBAT 2022*: Insightful panel discussion (on stage, left to right): *Professor Ryan Loxton* (Curtin University), *Dr. Gaurav Singh* (BHP Group Limited), *Dr. Elham Mardaneh* (Curtin University), *Dr. Christina Burt* (Fortescue Metals Group Limited).

The last day (16th of December) was dedicated to connecting researchers in academia and industry. We shared insightful discussions on the challenges and opportunities for applying optimization methodologies in industry and job prospects for our graduates. There were around 50 participants, with 30 participants from academia, undergraduates, and postgraduate students, and 20 participants from industry and local government. We enjoyed inspiring keynote talks given by *Dr. Fabrizio Padula* from Curtin University and *Dr. Gaurav Singh* from BHP Group Limited.

In-person events always provide us with the opportunity to enjoy fruitful discussions and form new ideas over coffee and lunch. We hope to see many collaborations arising out of *WOMBAT 2022*.

▲ *WOMBAT 2022*: Insightful panel discussion (on stage, left to right): *Professor Alex Kruger*, *PhD student Sandy Spiers*, *Dr. Reinier Diaz Millan*, *Professor Andrew Eberhard*, and *PhD student Alexander Lim*.

HOPER GRADUATE SCHOOL 2022 IN COLOMBIA HEALTHCARE OR: FIVE DAYS OF EXCITING EXPERIENCES AND INSIGHTS

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The first edition of *HOpeR* (*Healthcare Operational Research*) graduate school was held in Bogotá, Colombia, from November 28 to December 2, 2022. The school took place at the Pontificia Universidad Javeriana and was co-chaired by *Ana María Anaya-Arenas* (ÉSG-UQAM) and *David Barrera Ferro* (Pontificia Universidad Javeriana). *Sally Brailsford, María Camila Gómez, Elena Valentina Gutiérrez, Andrés Felipe Osorio, Janosch Ortmann, Johan Peña* and *Melanie Reuter-Oppermann* were part of the scientific and organizing committee. Detailed information is available at the school website. https://www.hoper-school.com/bogota2022.

HOpeR aims at providing advance training regarding both, problems and solution approaches, in the field of healthcare operational research. During this first edition, six speakers discussed challenges in creating and implementing decisions support tools in healthcare. >>

▲ *Chairs of HOpeR graduate school 2022* (from left to right): *David Barrera* and *Ana María Anaya-Arenas*.

▲ *Professor Erwin Hans, HOpeR* inaugural talk, November 28th, 2022.

>> They also presented strategies to engage stakeholders during the different stages of the research process. *Valérie Bélanger, Sally Brailsford, Erwin Hans, Nadia Lahrichi, Fermín Mallor* and *Ángel Ruiz* talked about different areas in which *OR* modelling approaches can be used to inform the decision-making process in the healthcare sector, including prioritization strategies, integrated capacity planning, home healthcare planning and more.

▲ Participants working on healthcare challenges presented by 5 experts from *District Health Office of Bogotá*.

The inaugural talk was given by *Professor Erwin Hans*. He presented an overview of the use of operational research in the health sector, discussed some applications and provided reflections on research impact.

Thirty participants integrated HOpeR22! 23 MSc and PhD students and 7 health practitioners (from the District Health Office of Bogotá and from private clinics) joined us. Among the 23 students, 13 were international (Canada, Spain, Germany, México) and 10 Colombian students. Moreover, 18 of our students presented their research projects and were able to get feedback from the group.

A group of five experts from the *District Health Office* of Bogotá led a team activity. Participants discussed the challenges facing Colombia's health sector in the context of a potential reform. Each group was tasked with identifying ways in which operations research can help address these challenges. The reports and discussions were presented in a panel and practitioners leaved the school with new ideas to tackle the coming challenge.

HOpeR participants also had an academic and social agenda. Students had the opportunity to present their work in a *"Thesis in three minutes"* session, where they received feedback from the speakers and the scientific committee. Participants enjoyed a welcoming cocktail, a walking tour around downtown Bogotá, an exciting dancing presentation, and a social dinner. All these spaces gave the participants the opportunities to share their ideas, learn from other participants' works, receive feedback, and meet new friends and colleagues.

▲ Students, speakers, and organizers of *HOpeR graduate school 2022*.

Next edition: Montréal 2025

The results of *HOpeR 2022* were beyond expectations. The chair committee is already working to host the next edition of the school in Montréal in the summer of 2025. Save the date! Looking forward seeing you there!

"DEEP LEARNING TECHNIQUES AND OPTIMIZATION STRATEGIES IN BIG DATA ANALYTICS"

by J. Joshua Thomas, Pinar Karagoz, B. Bazeer Ahamed, Pandian Vasant

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OR-Analytics through Deep Learning and Optimization

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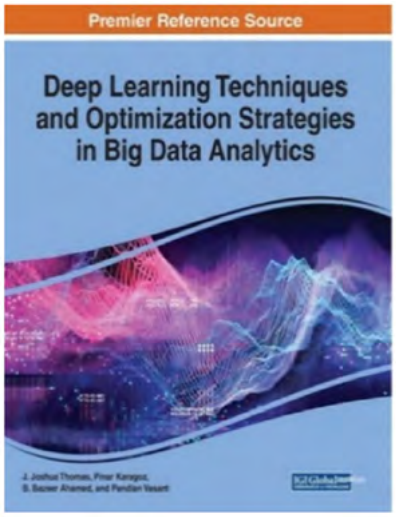
In today's times when big data is produced in almost all activities across various domains, this compendium by *J. Joshua Thomas, Pinar Karagoz, B. Bazeer Ahamed* and *Pandian Vasant* presents a rich selection of recent advancements and applications of *deep learning and optimization* strategies in big data analytics through algorithms and models to a variety of domains in general and *neuroscience* in particular. Neuroscience is a multidisciplinary science concerned with the study of the structure and function of the nervous system and comprising aspects of physiology, cellular and molecular biology, as well as behavioral and cognitive sciences. Recent technological and theoretical advances offer promising opportunities for better understanding of the nervous system at the quantitative level. New optogenetic, in vitro and in vivo multielectrode recording, neuroimaging, brain imaging, and other modern techniques provide high-quality data that can be used in elucidating the fundamental mechanisms of information processing in neural systems. The rapidly growing pool of experimental data has triggered the development of new mathematical models that can provide new insights into the functioning of the nervous system at various scales ranging from that of molecular biology to that of the organizational principles of behavior and cognition. Sophisticated analyses of intracellular signaling or dynamics in heterogeneous neural networks, conditional behavior, or connections of brain regions in decision-making lead to theoretical problems addressed by *Operational Research*. Several studies covered in this compilation reflect upon a broad range of topics in the field of neuroscience that use *OR* approaches and methods.[1] This well-organized compilation of 17 contemporary and novel research contributions discusses recent advancements with real-time and empirical illustrations to a wide range of sectors.[2]



▲ OR-Analytics through Deep Learning and Optimization for Big Data.

In terms of deep learning techniques, it covers features, structure and applications of neural models including Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Recursive RNNS, Bidirectional Generative Neural Networks (BGNN), Graph Neural Networks to a wide range of domains. In terms of optimization strategies, it covers various metaheuristic algorithms including genetic algorithm, Particle Swarm Optimization (PSO), Cuckoo Search (CS) and their variants.

This state-of-the-art compendium entails big data analytics and its applications to developments in fast-moving key technologies involving Artificial Intelligence (AI), Machine Learning (ML) and descriptive analytics approaches through deep learning and optimization strategies. It not only caters to all those who are interested in big-data analytics but also provides useful cases for AI researchers, physicians, neuroscientists, geological engineers, energy and agriculture specialists, etc.

A brief overview of the highlights of the chapters in this book follows:

Chapter 1 - Arrhythmia Detection Based on Hybrid Features of T-Wave in Electrocardiogram proposes an auto-encoder based deep neural network solution for arrhythmia classification by hybrid features of T-wave in Electrocardiogram (ECG).

Chapter 2 - A Review on Deep Learning Applications focuses on the application of deep learning techniques to various cases ranging from speech recognition and computer vision to virtual assistance, healthcare and self-driving cars to ground breaking advances.

Chapter 3 - A Survey of Nature-Inspired Algorithms with Application to Well-Placement Optimization highlights the use of PSO and Genetic algorithm for well-placement optimization problem in the oil and gas industry.

Chapter 4 - Artificial Intelligence Approach for Predicting TOC From Well Logs in Shale Reservoirs: A Review presents various AI based solutions to provide an understanding of the different Total Organic Carbon (TOC) content prediction strategies for shale reservoir analysis.

Chapter 5 - Bidirectional GRU-Based Attention Model for Kid-Specific URL Classification addresses the problem of webpage classification for parental control of web access.

Chapter 6 - Classification of Fundus Images Using Neural Network Approach proposes a hybrid approach, a combination of a supervised neural model and fuzzy logic, in order to detect hard exudates from diabetic retinopathy.

Chapter 7 - Convolutional Graph Neural Networks: A Review and Applications of Graph Autoencoder in Chemo-informatics exhibits the use of Graph Convolutional Networks and Graph Autoencoders in chemo-informatics.

▲ Compendium editors (from left to right): 1. *Professor J. Joshua Thomas*, KDU Penang University College, Malaysia, 2. *Professor Pinar Karagoz*, Middle East Technical University, Türkiye, 3. *Professor B. Bazeer Ahmed*, Balaji Institute of Technology and Science, India, 4. *Professor Pandian Vasant*, Universiti Teknologi PETRONAS, Malaysia.

Chapter 8 - Deep Learning: A Recent Computing Platform for Multimedia Information Retrieval describes the main features and techniques of deep learning for multimedia information retrieval.

Chapter 9 - Deep Learning Techniques and Optimization Strategies in Big Data Analytics: Automated Transfer Learning of Convolutional Neural Networks Using ENAS Algorithm focuses on Convolutional Neural Networks (CNN) and describes how Transfer Learning can be used to facilitate neural model construction and its training through the Efficient Neural Architecture Search (ENAS) algorithm.

Chapter 10 - Dimensionality Reduction with Multi-Fold Deep Denoising Autoencoder discusses the challenge that high amount of data and high dimensionality in data poses for analytics. It then highlights the advantages of nonlinear methods, especially neural network techniques over linear methods.

Chapter 11 - Fake News Detection Using Deep Learning: Supervised Fake News Detection Analysis in social media With Semantic Similarity Method summarizes various neural models used for fake news detection followed by presenting a solution that incorporates semantic similarity.

Chapter 12 - Heuristic Optimization Algorithms for Power System Scheduling Applications: Multi-Objective Generation Scheduling With PSO describes the use of stochastic weight trade-off chaotic mutation based non-dominated sorting PSO algorithm for power system scheduling optimization.

Chapter 13 – Multi-objective Optimization of a Biofuel Supply Chain Using Random Matrix Generators demonstrates the modification of CS technique using the random matrix approach to modify the stochastic generator segment for biofuel supply chain.

Chapter 14 - Optimized Deep Learning System for Crop Health Classification Strategically Using Spatial and Temporal Data focuses on the use of an optimized deep learning novel architectural neural model which strategically uses spatial and temporal features selectively in order to reduce the inference time to classify crops.

Chapter 15 - Protein Secondary Structure Prediction Approaches: A Review With Focus on Deep Learning Methods discusses the use of deep learning techniques for the prediction of protein secondary structure from a protein sequence.

Chapter 16 - Recent Trends in the Use of Graph Neural Network Models for Natural Language Processing describes the use of graphical neural models and their use in NLP problems and applications which include machine translation, visual question answering, reasoning and text classification.

Chapter 17 - Review on Particle Swarm Optimization Approach for Optimizing Wellbore Trajectory focuses on the use of PSO algorithm and models for wellbore trajectory optimization.

While this book wonderfully illustrates recent advancements and applications of *OR-Analytics* through big data analytics in deep learning and optimization strategies, many further scientific, practical and real-world applications may be explored.

[1] For more details on this, the reader may refer to
https://doi.org/10.1007/s10479-017-2633-x,
https://doi.org/10.1007/s10479-020-03574-z,
https://doi.org/10.1007/s10479-022-04697-1.

[2] Owing to limitations of space we are unable to add the names of all the authors of this book. However, the following link gives a brief description of the book and its authors - https://www.igi-global.com/book/deep-learning-techniques-optimization-strategies/231554#description.

"RISK MATRIX – RATING SCHEME DESIGN AND RISK AGGREGATION"

by Chunbing Bao, Jianping Li and Dengsheng Wu

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OR-Analytics – An Interdisciplinary Perspective [i]

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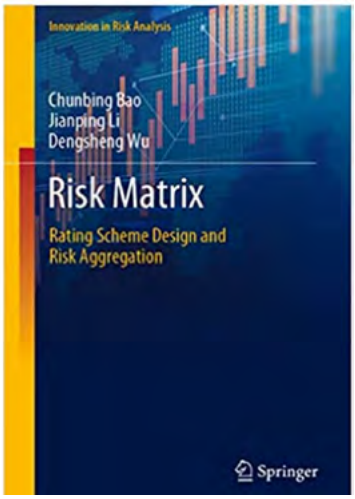
This book by *Chunbing Bao, Jianping Li* and *Dengsheng Wu* is predominantly concerned with risk matrix rating scheme design and risk aggregation. It deliberates on the new theories, new models, and new methods of risk analysis. It vividly explores the inter-relationships between risk, decision-making and society. It contributes immensely to the development of risk management methodologies and promotes better risk management practices in a diverse set of areas including social, physical and health sciences, engineering, public policy and administration, and media and communication studies. The book authors dexterously portray risk as an interface applicable to a wide range of interdisciplinary areas viz. *(i) Economics, Financial Sciences, Operational Research, Management Science* and *Analytics*, *(ii) Biology, Life Sciences* and the other *Sciences, Medicine, Health Care, Human Sciences, Social* and *Environmental Sciences*, *(iii) Mathematics, Statistics, Algebra, Combinatorics, Discrete Mathematics, Game Theory, Computer Science* and *Informatics*.



▲ OR Analytics – An Interdisciplinary Perspective.

The authors begin their book by illustrating the concept of risk through the COVID-19 pandemic and its associated diverse notions. This new monograph is theoretically rigorous, methodologically promising and based on strong and valuable references. This book connects very well to contemporary domains of risk like that in *Information transfer*, in *Coding theory, Cryptography, etc.,* where we know matrix concepts in terms of Generator matrices or Control matrices. It also relates well to *Data* or *Model resolution matrices, Smearing matrices* as applied to *Inverse Problems, Heat maps* as applied to *Meteorological* or *Life-sciences*. It is either in close proximity or stands in the foreground of *Engineering and Educational disciplines* including *their practical* aspects. It provides new insights in interval analysis and uses optimization very well. All basic definitions are supplemented with "operational", geometric representations and illustrations, appealing like *Discrete tomography, Radon transforms, Financial bubble detection, Experimental design, Switching boards* and *Graphical User Interfaces* (*GUIs*).

Risk assessment, Risk management and *Risk matrices* are of central importance in this book. Wherever the authors discuss the risk matrix, they usually explain it through a colorful graph. For example, each cell corresponding to some combination of dimension used to exhibit even a simple two-dimensional risk matrix demonstrating different levels of *consequence* and *probability* possesses a different color to reflect the respective risk level. For developing a clear understanding of the concept of risk matrix, the basic concepts of *risk, risk measure,* and *objective risk measure* versus *subjective risk measure*, are clarified first. Some other multifaceted concepts covered in this book include *Knowledge, Fuzzy measure, Choquet integral, Knowledge Strength* and *Multi-layer factors*.

The book can serve to enhance the knowledge of researchers and graduate students working in the area of matrix theory. Given its interdisciplinary perspectives, easy-to-understand language and illustrations, it can be utilized by anyone having basic mathematical background and willing to learn matrix theory.

A list of the chapters along with their contents in this book follows:

Chapter 1: Risk Matrix: Foundations and Overview presents the concepts of risk, risk management, risk assessment, and risk measure by citing scholarly research contributions. Second, it describes the difference between objective and subjective risk measures. It concludes by highlighting some theoretical flaws of risk matrix and the main topics covered in the book.

Chapter 2: Different Types of Risk Matrices and Typical Applications begins with the origin and evolution of the risk matrix followed by an explanation of fundamental mathematical model of the risk matrix. It elaborates the structure of the risk matrix as comprised of *M* x *N* cells denoting *M* categories of consequence and *N* categories of likelihood respectively. Next the classification of risk matrices into - qualitative, semi-quantitative and quantitative based on "likelihood" and "consequence" is presented. Next, the details of how to use the risk matrix to evaluate risks is explained. Lastly, application examples of the risk matrix to different fields like food safety, public infrastructure, medical and healthcare, etc., is described.

Chapter 3: Rating Scheme Design Methods starts by highlighting that the accuracy of risk matrix design directly affects the accuracy of risk assessment, but there is no uniform design standard yet. Second, it describes the risk matrix design steps which include: defining input variables, classifying input variables, and assigning a risk level to the cells corresponding to each set of input variables. Section 1 introduces the reader to Input classification, Measure of risks and Classification of different risks.

▲ Book authors: *Chunbing Bao* (Source: https://www.researchgate.net/profile/Bao-Chunbing), *Jianping Li* (Source: https://www.researchgate.net/profile/Jianping-Li-14), *Dengsheng Wu* (Source: https://www.researchgate.net/profile/Dengsheng-Wu).

While section 2 throws light on usage of utility functions to design qualitative risk matrix design, sections 3 and 4 explain Cox's risk matrix design axioms, sequential updating approach respectively followed by section 5 which presents the summary and comparison of the rating scheme design methods

Chapter 4: Risk Perceptions in Risk Matrix: Sources and Impact to Risk Matrix Design first introduces the concept of risk perception by citing scholarly contributions of various researchers followed by sections on *'Identifying risk perceptions in risk matrices', 'A sequential updating approach used to integrate different perception' and 'Risk matrices integrating different risk perceptions.'* It concludes with a summary of and a caution note on the design and usage of risk perceptions for risk matrices in practice.

Chapter 5: Risk Matrix Design Assessment: Criteria and Quantitative Indicators begins with an explanation of criteria used to assess risk matrix viz. monotonicity of risks, consistency with the risk measure and effective resolution of risk ratings. Section 5.2 covers the quantitative indicators of the criteria which include proportion of wrong risk pairs (PWRP), the volatility of risk measures (VRM) and Probability of a correct decision (PCD). Section 5.3 discusses the applications of the criteria including instructions for practitioners designing risk matrices, determination of risk rating for some cells and assessment of some of the risk matrices used in the literature.

Chapter 6: Risk Matrix Aggregation: A General Framework commences first explains the term risk matrix aggregation. A normal framework to aggregate risk matrices which comprises of - assessment of individual risk according to the normalized quantitative risk matrices, finding the appropriate expressions of the ratings, aggregating the individual risks by composition methods and transforming the result of aggregation into a specific value, is next discussed.

Chapter 7: Risk Matrix Aggregation Methods: Introduction and Comparative Analysis introduces various risk aggregation methods namely fuzzy set-based method, interval number-based method and probability density function-based method. The next section is based on comparison of different methods to aggregate risk matrices and covers an illustrative example, explains robustness of different methods followed by a comparison of the three aggregate methods.

Chapter 8: Three-Dimensional Risk Matrix: Theoretical Basis and Construction begins with the background explanation of the three-dimensional risk matrix. The next two sections focus on three-dimensional risk measure considering the strength of knowledge and its impact factors. This is followed by an elaborate explanation on the measure of the strength of the knowledge based on fuzzy Multi-Criteria Decision Making (MCDM) and includes *Multi-Attribute Decision-Making Method Based on Fuzzy Measure and Choquet Integral, Knowledge Strength Under Multi-Layer Factors and Knowledge Strength Under Multiple Decision Makers*. The next section explains the construction of three-dimensional risk matrices.

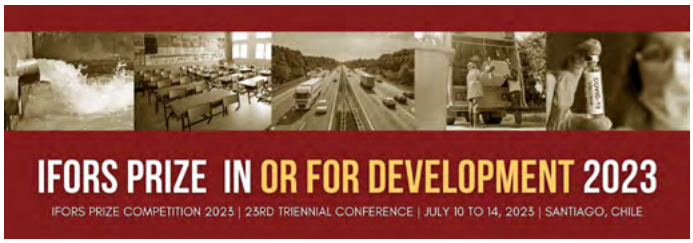
Chapter 9: Conclusions and Future Research begins with a summary of the two primary issues of the risk matrix covered in this book, i.e. - rating scheme design and aggregation followed by a note about the wide application of risk matrix as a qualitative risk assessment tool. In-depth insights into several important issues in connection with risk matrix design and aggregation viz. – *'A sequential updating approach for the rating scheme design of risk matrix', 'The effect of different kinds of risk perception on the risk matrix design', 'The criterion that can be used to assess the design of the risk matrix', 'A general framework for risk aggregation of risk matrices', 'Several detailed methods for risk aggregation of risk matrices'* and *'Extension from the two-dimensional risk matrices to three-dimensional ones'* are next provided. The book ends with a specific direction for future research about integrating subjective and objective methods in risk matrix design.

The book is well-organized, well-structured, and mathematically sound. It presents a new approach in that it allows for extensions in terms of Risk Tensors of any number of dimensions rather than just 2 or 3-dimensional matrices. As one or even more dimensions, *time* (or *times*) can be considered, it helps in simplifying the understanding of dynamical counterparts of risk matrices or risk tensors. Since each of the coordinate axes can be a point or cell-wise extension and have a generalized set-value, they can then in turn be considered as "tubular axes". This allows for the inclusion, representation and handling of many further kinds of uncertainty. Among the axes or generalized axes themselves we may also imagine generalized matrices, tensors, spectra, prisms or crystals. The first author of this report has introduced and illustrated such extensions during 2020-2022 in new ways for *"times and lives"*.

This book is enjoyable to read and truly an enrichment in matrix theory. While it remarkably presents the interface of risk with other disciplines, many future scientific, applied and real-world illustrations in various domains can be further explored in the vast and quickly expanding universe of modern research.

[i] This is an advanced version of the authors' book report for Zentralblatt Mathematik.

SIX FINALISTS VIE FOR THE IFORS PRIZE FOR OR IN DEVELOPMENT 2023



Awarded at every IFORS Triennial conference since 1987, the IFORS Prize for OR in Development aims to showcase and acknowledge high quality applications of OR in developing economy countries and economies in transitions. Past winners and finalists include works that have improved health, wellness, education, disaster relief, public investments and other issues in Africa, Asia and Latin America.

In this 2023 edition of the competition, the entries have been evaluated in two stages. The first one required a short summary, and the second one required a full-length manuscript describing the work in more detail. The evaluation criteria included problem definition, creativity and appropriateness of approach, MS/OR/Analytics content, stress on developmental issues, extent of involvement of local researchers and impact.

We are pleased to announce the following six finalists of the IFORS Prize for OR in Development 2023:

- "Improving Health Outcomes with Less Cost? Provision of Mobile Clinic in Developing Economies", by F. Liu, P. Guo, Y. Wang, Y. Xi;

- "OCP optimizes its supply chain for Africa", by E.M. Er Raqabi, I. Himmich, A. Beljadid, M.A. Bennouna, R. Bennouna, S-E. Boumahdi, L. Boussaadi, N. El Hachemi, I. El Hallaoui, M. Fender, H. Guellaf, A. Jamali, E.M. Mahboubi, A. Metrane, I. Rakhis, N. Si Hammou, F. Soumis;

- "Cooperative Traffic Light Signal Control: Optimization Models and Algorithms", by X. Yang, C. Wu, C. Gu, J. Pi, W. Liu, S. Xu, W. Liu, Z. Huang;

- "Data Science and Simulation Tools Developed at Public Universities for Supporting Argentina's COVID-19 Response Decision-Making", by R. Castro, R. Grimson, D. Feierstein, E. Kofman, E. Pecker-Marcosig, G. Durán, A. Farall, J. García, D. Parada, N. Kreplak, S. Gonzalez;

- "Safer Homeland: Developing Evacuation Simulation and Humanitarian Relief Logistics Models for Effective Disaster Preparation and Response in Taiwan", by K-H. Chang, T-Y. Hsiung, Y-Z. Wu, R. Cuckler, T-Y. Chang, S-S. Ke;

- "A model for land rent analysis and implementation of the national rural domain for the optimal management of agricultural land in West Africa", by E.A. Raimi, A. Alinsato, L.M. Hounsa.

The finalists will present their works during the 2023 IFORS Triennial conference in Santiago, Chile. Prizes of US$ 4,000 and US$ 2,000 await the first and runner-up winners, to be awarded during the conference banquet.

The members of the panel of judges are: Juan Villegas and Maristela Oliveira dos Santos, from ALIO; Elise del Rosario, Guiying Yan and Tava Olsen, from APORS; Dave Evans, Margaretha Gansterer and Roman Slowinski, from EURO; James Cochran and Monia Rekik, from NORAM; and Mario Guajardo, chair.

IFORS PRESIDENT ANNOUNCES THE NEW IFORS SECRETARY

Please join me in welcoming Mr. Gavin Blackett as the new Secretary of IFORS.

The IFORS Secretary provides essential administrative support for the IFORS Administrative Committee and serves as a main liaison between the IFORS AC and Member Societies. I am very glad that Gavin, who had been the Executive Director of the Operational Research Society of the United Kingdom for many years, has taken up the IFORS Secretary position from 1st March 2023.

In the transitional period until the end of June 2023, Mary Magrogan will also be offering part-time administrative support. The email for the IFORS Secretary remains as secretary@ifors.org. Do please let Gavin know how the IFORS AC can support the work of your Society.

May I also take this opportunity to express IFORS' deep appreciation of Mary Magrogan for her many contributions and dedicated service as IFORS Secretary for the past 23 years!

Janny Leung, IFORS President

GLOBAL WEBINAR ON OR AND SUSTAINABILITY

We are pleased to announce the next edition of the IFORS Webinar.
Date: Thursday, April 27, at 9am (Washington time)
Speakers:
- Adrián Ramírez Nafarrate, Tecnológico de Monterrey (Mexico)
- Michael Craig, University of Michigan (USA)
- Kristen R. Schell, Carleton University (Canada)
- Marc Reimann, University of Graz (Austria)

More information will be available soon in www.ifors.org. Stay tuned!

Submissions are open until March 30th!

We are waiting for your contributions for the 23rd Conference of the International Federation of Operational Research Societies (IFORS 2023), which will take place in Santiago, Chile, next July. The conference is locally organized by ICHIO, the Chilean Institute for Operations Research, together with ISCI, the Institute of Engineering Complex Systems, and with the support of the University of Chile and the Pontifical Catholic University of Chile.

Sessions are being organized right now and the Program Committee is reviewing the abstracts that have been already sent so, we recommend submitting your contribution as soon as possible. Instructions are available in the conference webpage, www.Ifors2023.com. If you want to organize a session in one of the many topics of the conference, you should contact the relevant cluster chair.

The conference will feature exciting plenaries and a number of invited keynote talks covering a wide range of Operational Research and Analytics subjects. Also, a number of tutorials on current topics will be offered.

Wednesday during the conference will be the opportunity to tour around Santiago and the Organizing Committee has assembled a wide variety of options. For instance, there will be tours to the vineyards near Santiago. Also, we plan to visit the famous port city of Valparaiso and also Sewell, an old mining town in the mountains, and the possibility of visiting the ski centers near Santiago. Information is available in the conference webpage.

We have also compiled a list of hotels in Santiago which will offer special rates for conference attendees. Check the "Venue" area of the conference webpage for further information. Remember that registration will open in March.

The conference will be a great opportunity to meet with researchers from all over the world and discuss about the diverse potential of state-of-the-art Operations Research techniques as well as visiting Chile and explore its culture and diverse nature and landscapes.

We look forward to seeing all of you in person in Santiago in July 2023!

IFORS 2023 Organizing and Program Committees

IFORS NEWS Editor in Chief: Antonio Mauttone