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IFORS NEWS

International Federation of Operational Research Societies

FROM THE PRESIDENT

The IFORS Fellow Award

Grazia Speranza <grazia.speranza@unibs.it>

The daily life of operational researchers certainly depends on whether one works in academia or not. It is probably easier for non-academics to explain what they do. They work for a company which has a mission, they solve or contribute to solving real problems. The life of academics is filled with several different kinds of activities but it is more difficult for academics to explain what they do besides teaching that is something everyone understands. It is especially hard to explain that they are awfully busy when the number of hours they teach is so small compared to that of high-school teachers. Good teaching requires a lot of preparation, yes. However, I believe that for most of us a large portion of time goes into research: our individual research, the interaction with colleagues, writing of a paper and the revision of a submitted paper. Several other activities are research-related, like writing grant proposals, attending conferences and giving talks. There are also all the committees we are members of, inside the department or the university and outside. Reviewing others' papers for journals is another important time-consuming activity we do for each other. In addition, we have contacts and work with companies, institutions and authorities.

The activities I want to focus on in this editorial are those of service to the international community. There are different ways to connect international communities and to develop operations research internationally. We all contribute to this through our international collaborations. However, the scientific associations and the international conferences are the main structured tools through which our international lives develop. Through IFORS, its 54 member national societies and the regional groupings ALIO, APORS, EURO, NORAM, several regular initiatives take place, conferences are organized, awards and prizes are given, websites are maintained. In general, the scientific associations keep our communities connected as such and not only as individuals or small groups. Behind the scenes, there are many colleagues who work hard to organize and run the activities; to make things happen.

Being aware of the importance of developing operational research internationally, IFORS has last year decided to introduce a new award and to recognize distinguished individual's contributions to international operational research and its communities with the IFORS Fellow Award. The IFORS Administrative Committee has defined the eligibility conditions, the evaluation criteria and the nomination process. Moreover, an initial set of IFORS Fellows, the 2020 awardees, was identified among the colleagues who gave fundamental contributions to the foundation and development of IFORS. We are where we are today thanks to them. You can find all the details about the IFORS Fellow Award and the names of the 2020 awardees on the IFORS website. During the IFORS2021 conferences the names of the 2021 awardees will be announced. Don't miss the IFORS2021 conference!

WHAT'S INSIDE

EDITORIAL

Sunity Shrestha Hada <sunity.shresthahada7@gmail.com>

The year 2020 has been very challenging to the whole world due to COVID-19. The year 2021 is facing another cycle of Corona variant which the whole world is trying to cope up with. We must salute all the health workers for their humanity and spirit of fighting against the disease. In spite of all these global problems the OR scientists were working on research, publications and conferences in their respective regions. The June issue of IFORS newsletter is now released during the pandemic situations.

The June issue of IFORS newsletter is special in the sense that it covers the reports from all Administration Committee (AC) members of IFORS. The annual activities reports which have taken place in 2020 in the respective member societies of the four regions are presented by Rosiane Freitas for ALIO, Sunity Shrestha Hada for APORS, Stefan Nickel for EURO and Karla Hoffman for NORAM. The reports from the IFORS officials such as the president of IFORS Grazia Speranza, the immediate past President Michael Tick, the vice president Chang Won Lee, the treasurer Richard Hart are the highlights of this issue. The 5th IFORS global webinar report by the African Federation of Operations Research Societies (AFROS) written by Hatem Masri (President of AFROS) and Sue Merchant (IFORS Developing Countries Committee) is presented in this issue.

All the permanent sections such as the OR Impact (John Ranyard and Sue Merchant), OR tutorials (Javier Marenco), OR and Development (Rosiane Freitas), the conference reports (Gerhrd Willi Weber), and the Book Review are included. The section editors of all the sections are highly appreciated for their continuous effort and dedication.

The article on OR Impact is about the Physician rostering in a large Brazilian hospital during Covid-19 pandemic and is written by Luciana and her team. In it they discuss how, in pandemic situations, the physicians' works are scheduled in Brazilian hospitals. The OR and Development article focuses on the ATM management of the banking sector in a developing country like Guatemala and is written by Ramiro Bolaños, CEO of Improvement & Progress, S.A. The article on OR Tutorial discusses the Karush-Kuhn-Tucker conditions and is written by Maria L. Schuverdt and Leonardo D. Secchin.

We hope the postponed IFORS triennial conference to be held in Korea in August 2021 will be a grand success at the highest level.

Report of the IFORS President

Grazia Speranza <grazia.speranza@unibs.it>

The year 2020 will remain in the history of each and every country on the planet for the same reason, the COVID-19, the virus responsible for the death of more than 3 million people. While writing this report, my thoughts go to the members of our community we have lost and to the family members, the colleagues, the friends many of us have lost in 2020.

The health emergency has also had enormous repercussions on the social system and on the economic one. It has impacted also our professional lives. We learned to teach through a broad set of platforms. We first postponed and then cancelled conferences, flights and visits. We attended a number of webinars, and we gave webinars ourselves too. Precious experiences in months spent almost entirely at home were gained, yet these were far less exciting than the events we were used to in our academic lives.

The IFORS Administrative Committee (AC) is composed of people who come from all continents. It is impossible to regularly meet in person, even if we were allowed to. We have always worked through regular virtual calls, and we have continued in 2020. Well, in fact, we hoped to meet in Seoul for the triennial conference in June 2020 but, as you know, the conference was moved to August 2021 and then became virtual.

Let me briefly recall here how the responsibilities are distributed within the AC: "David" Chang Won Lee – website; Richard Hartl – finances; Rosiane de Freitas - developing countries; Karla Hoffman - conferences; Stefan Nickel - publications; Sunity Shrestha Hada - newsletter. Together with myself, Mike Trick, who is the past president, and the IFORS secretariat, Mary Magrogan and Christy Blevins, the team is complete. I take this opportunity to express my gratitude to this incredibly committed team who has worked hard for the good of our community.

And now it is time to summarize the activities we carried out in 2020.

Conferences. IFORS2020 was moved to 2021 and has become IFORS2021. It will be a virtual conference for all except the colleagues from South Korea. The Program Committee of IFORS2021 has two co-chairs, Natashia Boland and Bernard Fortz, while Suk-Gwon Chang remains the chair of the Organizing Committee. The two committees are working hard to make IFORS2021 a great conference. It will be different from an in-person conference but it will be a memorable experience.

Global webinars. In June 2020 the series of IFORS Global Webinars was initiated. The first webinars of the series were devoted to present some of the best research from 3 IFORS regional groupings, ALIO, APORS and EURO. The recordings are available on the IFORS website together with those of the webinars organized in 2021, devoted to NORAM, the fourth regional grouping of IFORS, and to AFROS, the federation of the African societies.

Newsletter. The issues of the IFORS Newsletter have become richer and richer, covering the news about the IFORS activities, but also containing book reviews, tutorials and reports on the many virtual webinars and conferences that have kept us linked to each other in 2020.

Publications.
ITOR, the IFORS flagship journal, has become one of the top journals in our field, thanks to the commitment of its Editor-in-Chief, Celso Ribeiro, and its editorial board. 799 papers were submitted for publication and 123 were published in 2020. The impact factor of ITOR is not yet officially known for 2020. However, it was 2.987 in 2019 and is expected to substantially increase in 2020.

In 2020 IFORS has announced a new journal, the Sustainability Analytics and Modelling journal (SAM), and its Editor-in-Chief, Elise Miller-Hooks. The journal publishes articles that develop and apply quantitative methods of analytics and operations research (OR) to take on the many global sustainability challenges.

This is intended to be an outlet for the best research in this field, to show that OR can contribute to make human activities more sustainable.

Website. The IFORS website has been renewed in 2020. The layout has been improved and the content reorganized. We are still working on it. Feedbacks and suggestions are welcome.

Developing countries. The Developing Countries Committee has been focused, as always, on supporting initiatives organized in developing countries. All actions are aimed at disseminating the knowledge and use of operations research in developing countries, which eventually may lead to the foundation of new societies and enlarge the IFORS family. The African continent has been more active than ever in 2020 and we hope to see further developments in the near future.

Finances. The finances of IFORS are solid. 2020 was a year of small revenues and small expenses that have not much changed the IFORS financial situation.

I wish to acknowledge here also the support of the many friends and colleagues who have collaborated with us at the IFORS activities in 2020. Thank you so much!

Finally, I close this report with warm wishes to you all, in the hope that we are all living out the months of transition from a COVID difficult life to a post-COVID (almost) normal life.

Report of the Immediate Past President

Michael Trick< trick@cmu.edu >

The past year has been a very active one for IFORS, despite the impact of the ongoing pandemic. I have been engaged in two main activities during the year. The first is the continuation of our efforts to register IFORS as a Switzerland-based non-profit organization. This registration is a necessity due to changing bank regulations making our previous organizational structure less than ideal. This registration has been a difficult journey, but the end is in sight, due to the incredible efforts of the EURO Treasurer Marino Widmer. We could not have done this without him. With a successful registration, future leaders of IFORS should find it much easier to handle the finances and contracts for IFORS.

The second aspect that I have been involved with has been the Fellows program. As envisaged by the AC, a Fellow of IFORS would be a leader in operational research education, research and/or practice who has had an impact on international operational research, generally through service to the profession and its societies. To start this program, all living Past Presidents were named to the initial group of Fellows. A call for nominations for the next group was distributed, and we received a number of nominations. The Fellows Selection Committee (the most recent three Past Presidents) determined base eligibility, and distributed the valid nominations to all the Fellows, who provided feedback on each nomination. Shortly, the Selection Committee will makes its decision on the next class of Fellows.

In addition to these activities, it is the responsibility of the Past President to identify nominees for President and Vice President, again as part of the group of three most recent Past Presidents. We successfully identified two outstanding nominees: Prof. Janny Leung for President and Prof. Fritz Spieksma for Vice President. There were no other nominees for these positions, so Prof. Leung and Prof. Spieksma will take up their new positions January 1, 2022, when I will, after 12 years on the IFORS Board, finally depart the Board.

Report of the IFORS Vice President

"David" Chang Won Lee < leecw@hanyang.ac.kr >

Founded in 1955, IFORS has maintained its reputation as a representative of the world's operations research (OR) and analytics field. It is a great honor to serve as a vice-president in this wonderful federation. Now this term has less than a few months left. However, the current administrative committee (AC) members, past presidents, fellows, and representatives will all try to further enhance the status of the IFORS.

The importance of OR and analytics is becoming more important. In particular, IFORS has made tremendous progress through the dedication of all member countries. However, with COVID19, the era of tuncertainty has come to us, and it is time for a preemptive response.

We are at a turning point in the era when we must prepare for a fundamental paradigm shift while preserving the mission and values that IFORS has been pursuing. It is calling for a fundamental change in the theory and practice of the new OR. In that context, current AC has made several significant changes over the past year. Various issues were discussed with the president and the current administrative committees, and great results were achieved. I would like to share some of them.

First, in the context of COVID19, IFORS has activated a more multidisciplinary perspective and global network. IFORS prepared to proactively respond to changes in the global paradigm. To this end, a global webinar was initiated and successfully held quarterly.

Second, IFORS endeavored to share a new agenda, including social values, job creation, and urgent issues with other academic organizations. To this end, several joint academic conferences were held with various academic organizations. For example, IFORS participated as a co-host at the Fall Joint Conference of the Korean Association of Business Education (KABE), where I served as the president of the society last year.

Third, a systematic platform has been created to ensure greater academic freedom and promote friendship and exchange among members, which is a long tradition of our IFORS. To this end, the web platform was newly developed and changed to a more user-responsive system.

In August 2021, the IFORS conference, which was scheduled to be held in Seoul, Korea in 2020, will be held at my university, Hanyang University, Seoul Campus. We hope that this event, held online and offline, will be more meaningful and a place of knowledge and exchange and make a new meeting style for the future. May you be safer and healthier and God bless your work.

Report of the Treasurer

Richard Hartl <richard.hartl@univie.ac.at>

The 2020 budget (approved by the IFORS AC) showed an operating deficit of $ 19,974. In years with an IFORS triannual conference, we usually observe a certain surplus to compensate the deficit in the two years in between. However, a conservative forecast for 2020 (based on a scenario with low attendance at the Seoul conference) showed a deficit. It turned out that the Covid-19 pandemic also changed the financial numbers of IFORS significantly. In fact, IFORS did financially much better than projected. In short, the reason is that the income of the triannual conference disappeared, but also most expense items disappeared or were reduced significantly. Before accruing (done by the auditor) the unaudited budget shows a small deficit of $ 1,251.

What follows is a summary of the unaudited results for 2020 (all numbers in $US). The publication revenues of $ 61,792 from ITOR were slightly above the budget of $ 55,000, due to exchange rate differences and a new contract. Members' dues collections at $ 21,518 were slightly below budget. Interest revenue continued to be positive but small, due to the globally low interest rates. The most dramatic change compared to the budget was the cancelling of the Seoul conference in 2020, which is why we did not have any conference income (while $ 120,000 was projected). The effect of these revenue movements was an income of $ 83,624, significantly lower than the budget of $ 199,000.

On the other hand, 2020 spending at $ 84,875 was also significantly below budget ($ 218,974). Many items did not materialize at all, such as expenses related to the Seoul conference, the Developing Countries activities, the summer/winter schools, the travel expenses of the AC, and the expensed for IDL/ITL. The main expense items that remained where related to the ITOR editorial team ($ 21,400), the IFORS website ($ 4,493), a site visit at the location of IFORS 2023 ($ 2,399), and the IFORS newsletter ($ 1,400). All of these were significantly below budget. It was also possible to reduce the expenses for our office from over $ 60,000 to below $ 50,000 and this reduction will remain for the next years. Bank charges and cost for auditing stayed roughly as projected. We also made some progress towards getting registered as a non-profit organization in Switzerland, which caused expenses of $ 2,039.

2019 IFORS Financials

			Approved Budget 2020	Unaudited Actual 2020
INCOME				
Member Society Dues			22,500	21,518
Royalties	ITOR		55,000	61,792
Interest			1,500	314
IFORS 2020 Conference Seoul:			120,000	
TOTAL INCOME			***199,000***	***83,624***
EXPENSES				
Activities	Administrative Committee		18,000	
	Publications Committee			
		IAOR Webhosting	1,200	
		ITOR Editor	26,000	21,400
	Scientific Activities & External Affairs			
		IDL, ITL, Fellowships, & Grants	6 ,000	204
		IFORS Website	7,000	4, 493
		Summer/Winter Schools	10,000	
	Meetings Committee		7,500	
		Seoul 2020	35,000	
		Site visit Santiago/ Chile 2023	5,000	2,399
	IFORS Newsletter		11,000	1,400
	Developing Countries Committee		20,000	
General Business Operations				
	Office & Secretary		63,274	48,960
	Auditor		2,000	2,595
	Bank Charges		1,500	1,385
	Contingency		2,500	
	Preparation new legal structure		10,000	2,039
TOTAL EXPENSES			**218,974**	**84,875**
OPERATING RESULT			***(19,974)***	***(1,251)***

As mentioned, a deficit of almost $ 20,000 was budgeted, while end of December the actual unaudited deficit was only $ 1,251. While the Covid-19 epidemic negatively affected almost every aspect of our lives, it did not cause any damage to the financial situation of IFORS.

Total assets of IFORS consist of checking accounts with the Bank of Ireland and the Bank of America and Investments with the Bank of Ireland, totaling $ 1,425,215 by the end of 2020. Typically, the audited numbers will be slightly higher mainly because part of the ITOR profit share (for 2020) is paid in the year after (2021) while the auditor does some accruing and adds these to credits in 2020.

Summing up, 2020 did not materially change IFORS financial strength. In view of the Federation's financial position, no change in member society dues is recommended at this time. However, since the annual deficits remains high, IFORS will have to find additional sources of income. Therefore, in 2020, a new journal, SAM, was founded which - in the medium and long run - should create some income from royalties.

The original budget for 2021 showed a deficit of $ 51,700, which is typical for a year without a triannual conference. However, the 2020 conference was deferred to 2021 and will be online. To date it is not clear how much income IFORS will get from this conference, but it is safe to say that the deficit will be lower than projected or we will even have some surplus.

Report of the Vice President representing ALIO

Rosiane de Freitas <rosiane@icomp.ufam.edu.br>

After more than a year with the world still suffering heavily from the impacts caused by the COVID-19 pandemic, the promising advent of various types of vaccination available has provided many countries with a reduction in restrictions on mobility and social coexistence. However, in Latin America, with the insufficient number and the consequent slow process of vaccinating populations, there is currently an increase in cases of this disease in many countries and the return of greater concern regarding the emergence of a new strong wave of contagion.

As in other aspects, the Association of Latin-Iberoamerican Operational Research Societies (ALIO) were heavily impacted this past year. It was not possible to hold "The Latin American Congress of Operational Research" (CLAIO 2020), to be held in Spain, even after being postponed to 2021 and considering possible dates and formats, with the organization informing about its cancellation. Likewise, "The Latin American School of Operational Research" (ELAVIO 2020), whose tradition of strengthening relationships between young researchers in training and whose in-person performance is considered essential, and which was scheduled to take place in 2020 and postponed to 2021, which would be held in Peru, was also canceled. However, on the other hand, it was precisely in conjunction with ALIO that the successful IFORS Global Webinars series was started, with the "1st IFORS Global Webinar - O.R. in Latin America: from Theory to Practice", being held on July 29, 2020, an entirely virtual event with 3 invited speakers and more than 200 participants. It is noteworthy that in some countries it was possible to organize the national O.R. conferences in 2020, as was the case of the JAIIO 2020 (SADIO) and the ENDIO/EPIO 2020 held in virtual mode, in Argentina. In Brazil, it was also possible to carry out "The Brazilian Symposium on Operational Research" (SBPO 2020), in virtual mode. In this case, it is worth mentioning the lecture given by Grazia Speranza, President of IFORS, at "The 2nd Meeting of Women in O.R.", a pioneer in the discussion of the topic with actions to attract young girls to careers related to O.R. (STEM – Sci,Tech, Eng and Math - in general), to show role models, and to discuss about many issues as to maintain Brazilian (and Latin American) women in representative and leadership positions

The Association of Latin-Iberoamerican Operational Research Societies (ALIO) was created in Rio de Janeiro in November 1982, with the purpose to promote the exchange of experience and information among researchers, academics and professionals related to Operational Research in the region, as well as the circulation of techniques and methodologies related to these disciplines. ALIO is also the Latin American Regional Chapter of IFORS. National societies taking part in ALIO are those from Argentina, Brazil, Chile, Colombia, Cuba, Ecuador, México, Peru, Uruguay, Spain, and Portugal.

For this year 2021, several small O.R. meetings have been organized, in addition to the national O.R. conferences to be held in Latin American, in virtual or hybrid mode. For more information on other O.R. LATAM events, please visit ALIO´s website: http://www.alio-online.org/.

Developing Countries Committee (DCC)

The members of the Developing Countries Committee (DCC) have been involved in several pertinent issues concerning the developing countries activities. Some of these activities were related to the interaction with the O.R. research groups and societies in Africa. Sue Merchandt and Gerhard Weber have been playing a fantastic role, integrating important regional committees and actions even in these times of pandemic, in virtual mode.

One important DCC/IFORS action was to support the sequence of the Operations Research Techniques and Applications School for Africa (ORTASA). The first edition took place in 2018, in Dangbo, Benin, November 20-29, as reported in the March 2019 issue of IFORS News. The second edition will be held in October 2021 (further information in https://www.ceasma-benin.org/). We also maintain long-term support for the successful ELAVIO, the annual O.R. school of ALIO (Latin America), with the intention that the next edition can take place in 2022.

We must highlight the important presence of The African Federation of Operations Research Societies (AFROS) in strengthening the union of national O.R. societies, with Hatem Masri's AFROS President strong role in a process that has been moving very well towards becoming one more scientific society that is part of IFORS. A joint action carried out between IFORS and AFROS was the organization of the V IFORS Global Webinar for Africa, presented by the President of AFROS and mediated by Sue Merchandt, with 3 invited speakers from different African countries and O.R. issues, having great repercussion and reaching the objective to promote discussion and integration of the African community with the international O.R. community

Report of the Vice President representing APORS

Sunity Shrestha Hada < sunity.shresthahada7@gmail.com >

There are 12 member countries in APORS. In spite of the adverse and challenging situations of year 2020, there were various activities in the member societies of APORS. The triennial APORS conference scheduled for 2021 had to be postponed to 2022, but Pre-APORS conference was organized by OR Society of Philippines on September 2020. All 12 member societies' representatives and all the regional society representatives participated in the online conference. Some reports of member society's annual activities are presented.

OR Society of China (ORSC)

Prof. Xiaodong Hu <xdhu@amss.ac.cn>

The 15th Biennial National Conference of ORSC was successfully held in China's central hub city of Hefei from October 15 to 18, 2020, with a record high of nearly 900 participants. Prof. Maria Grazia Speranza, the president of IFORS from The University of Brescia, was invited to give a virtual talk entitled by "Trends in Transportation and Logistics" because of travel restrictions.

The annual meetings of some special interest group of ORSC were successfully held face-to-face in different cities in mainland China, including Behavioral OR at Nanjing, Scheduling at Dalian, Computational Systems Biology at Shenzhen, while many others were held virtually.

During the pandemic of 2020, ORSC launched its weekly online seminars on various hot topics and directions of OR since April. So far, more than ten thousand scholars and graduate students were present in a total of 51 such seminars.

Currently, ORSC have two journals in Chinese: OR transaction (4 issues/year) and OR/MS (monthly) receiving papers written in Chinese, and an English Journal of ORSC published with Springer (quarterly, EI) http://www.springer.com/mathematics/applications/journal/40305 This new English journal aims to publish excellent articles on the important and original results on OR related theories and methods. The authors are from China and from the outside of China.

Operational Research Society of India (ORSI)

Kalyan Mitra <kalyan_mitra_2000@yahoo.com>

ORSI participation in APORS virtual conference on theme "OR: Continuing Relevance in Challenging Times" held during September 23-24, 2020 participated by Prof. Kalyan Mitra (President ORSI), Prof. Vijay Chandru (Former President of ORSI) & Prof. Nita H shah (Vice President of ORSI) respectively presented the papers " Decision Support in Screening and Testing Populations in a Pandemic" " Handling Double Whammy in Covid Time: Demand and Supply Disruption and Recovery through OR Models"

The Operational Research Society of India organized 53rd Annual Convention in collaboration with Operational Research Society of Nepal during 17-20 December 2020 on the theme "Role of Operations Research during Pandemic" on virtual platform ZOOM. This webinar was attended by more than 100 participants and 21 eminent speakers from India, Nepal and abroad. The first talk was by IFORS President Prof. Grazia Speranza on "Trends in Transportation and Logistics".

The Internet of Things (IoT) refers to a system of interrelated, internet-connected objects that are able to collect and transfer data over a wireless network without human intervention. The personal or business possibilities are endless. Related to IoT there were two talks namely "Options for using Artificial Intelligence in agribusiness logistics for reducing food waste with IoT sensors" and "IoT for Quality Control".

SIR model to study the growth of pandemic in Nepal, to evaluate the basic reproduction number R0 in Nepal and policies to be adopted to lower R0 by maintaining social distance and stay home policy were and the role played by local government to implement these policies were presented during this webinar.

Iranian OR Society (IORS)

Nezam Mahdavi-Amiri <nezamm@sharif.edu>

IORS has been engaged to uphold quality and extend reliability of scientific activities relating Operations Research in Iran and beyond. The activities included research, education and administrative affairs concerned with Operations Research.

Regular monthly meetings of the executive council of IORS (website: www.iors.ir) were held. Several local seminars were conducted in various parts of the country. The 13th annual International Iranian Operations Research Society Conference (IORC) was held in Shahrood University of Technology, Shahrood, September 6-9, 2020 (website: http://icors2020.shahroodut.ac.ir/en); due to Covid-19, the conference was held virtually. >>

The conference received about 400 papers, of which about 250 as oral presentations and 50 as posters were accepted. There were also 4 workshops organized on various topics. A book of abstracts and a CD containing the talks were published. In the closing ceremonies, announcement was made for the next annual international conference of IORS to be held at Sadjad University in Mashhad, October 19-21, 2021: https://icors2021.sadjad.ac.ir/en; international participations are specially welcomed.

During 2019-2020, several issues of the Iranian Journal of Operations Research (IJOR) were published in English; see iors.ir/journal. IJOR sincerely welcomes international contributions.

The Operations Research Society of Japan (ORSJ)

Takamori Ukai <ukai@nda.ac.jp>

ORSC operates about 20 research sub-societies/groups to promote the propagation and application of operations research. In 2020, we launched new research sub-societies/groups for the energy system evolution and data-driven marketing. As same as many countries, our activities were restricted due to the pandemic of COVID-19. Particularly, face-to-face meetings were requested to refrain. We have planned to host our autumn research conference in Hokkaido, we had to cancel it in order to avoid mass gathering. In spite of such situations, members kept continuing their researches, and many research meetings were held online. On March 2nd and 3rd, 2021, we hosted spring research conference online. We held 42 sessions with a total 118 oral presentations conducted. Other ORSJ activities include our support for young researchers. In 2020, we had decided financially support a young researcher in his stay abroad, however, it was postponed.

Management Science and Operations Research Society of Malaysia (MSORSM)

Adibah Shuib <adibah@tmsk.uitm.edu.my>

MSORSM conducted about four to six Council Meetings per year. But, in 2020, we managed to hold two meetings only. In the Pre-APORS Conference organized by OR Society of Philippines on 23 - 25 September 2020, MSORSM was represented by its Vice President, Assoc. Prof. Dr Zulkifli Mohd. Nopiah, who presented a paper titled "Solid Waste Management and System Dynamics: A Trend Analysis on Application of Methodology."

MSORSM co-organized the 2nd National Seminar on Optimization and Data Sciences (NSODS2020), held from 26 - 27 September 2020 at Wyndham Acmar, Klang, Selangor, Malaysia. This seminar was co-organized by the MSORSM and the Centre for Actuarial & Analytics Research, Sunway University Malaysia with participants from local universities with one keynote speech, nine invited speeches and four research paper presentations.

MSORSM has also established research collaboration with the Royal Malaysian Police (RMP) with the first meeting held on 5th November 2020. The research collaboration's focus areas are the application of Data Envelopment Analysis (DEA) and the development of crime index.

The MITRANS-MSORSM Webinar Series 2020/21 is a collaboration between Malaysia Institute of Transport (MITRANS), Universiti Teknologi MARA (UiTM) and the MSORSM. Four MITRANS-MSORSM Webinar Series were planned. The MITRANS-MSORSM Webinar Series-1 was successfully conducted virtually on 18 November 2020 using the Webex Meetings platform with 122 participants. The guest speakers for this webinar were Assoc. Prof. Dr. Lee Lai Soon from the Institute for Mathematical Research (INSPEM), Universiti Putra Malaysia (UPM) with the talk titled "Urban Transit Network Design Problem: The Journey So Far"; and Assoc. Prof. Dr. Norhaslinda Zainal Abidin from the School of Quantitative Sciences, College of Arts and Sciences, Universiti Utara Malaysia (UUM) presenting "Tackling Traffic Congestion in Urban Areas: Evidence from a Model." MSORSM President, Assoc. Prof. Ts. Dr. Adibah Shuib moderated the session.

The MSORSM Award was first introduced in 2010 during the APORS2010 Conference organized by MSORSM. This award is an MSORSM approach in recognizing research and impactful activities related to Operations Research (OR) or Management Science (MS). The third MSORSM Award, organized in November 2020, only considers the categories of Doctor of Philosophy Thesis and Master Thesis.

Operational Research Society of Nepal (ORSN)

Govinda Tamang <govindagparang79@gmail.com>

ORSN conducted Pre conference workshop on R from January 30-31, 2020. There were 40 research scholars from Gandaki Province. ORSN conducted 11th ORSN International Conference with theme OR and Development from February 1-2, 2020 in Pokhara, Nepal.

About 125 participants from Nepal, India, Japan and China participated in the conference. The virtual Enterprise business simulation competition was conducted from April 24 to May 10, 2020. In this competition 10 virtual teams from School of Management Tribhuvan University took part. The competition got both technical and academic support from South Western University of Finance and Economics (SWUFE), Chengdu, China.

ORSN conducted eight webinar series from 2nd May 2020 to 11 July 2020. The webinar series covered various aspects of operations research including socio-economic, health, labor, New normal in COVID-19 era. ORSN president Dr. Govinda Tamang , ORSN members Mr. Pravat Uprety and Dr. Urmial Pyakurel participated and presented papers in Pre APORS online Conference 2020 [September 23-25,2020]. ORSN supported OR Society of India ORS I in conducting International webinar: Role of operations Research During Pandemic from 17-20, December, 2020. ORSN has joined with Prince of Songla University, Hatyai, Thailand in organizing International Conference (Online mode) on Sustainable Energy for Mitigation & Adaptation of Climate Change and Global warming (May 28-31, 2021) . Prof. Dr. Sunity Shrestha Hada, the founder president of ORSN is Conference Chair. It is also organizing Enterprise Business Simulation Competition with support from SWUFE, China from May 10 to 16, 2021.

This time 37 virtual teams of MBA students from Tribhuvan University and Purbanchal University of Nepal are competing.

Operations Research Society of New Zealand (ORSNZ)

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ORSNZ had a burst of activity early in 2020 that quickly abated as New Zealand dealt with the COVID-19 pandemic. There were three activities in February of 2020: i) International Workshop on Planning of Emergency Services OSHA ran the 6th International Workshop on Planning of Emergency Services, Feb 17-19, 2020 – highlights were visits from Prof Shane Henderson (Cornell University) and Prof Peter Taylor (University of Melbourne), as well as a visit to St John Ambulances HQ (thanks David Richards). Big thanks to Caroline Jagtenberg (SIG Leader of OSHA who has returned to the Netherlands) ii) Prof Vicky Mabin was part of a team that won the Griffiths Medal from The Operational Research Society iii) ORSNZ hosted talks on Women in Data Science from Prof Margot Gerritsen and Interpretable AI from Prof Dimitris Bertsimas. It was great to have these esteemed visitors and get to see them in action.

Later in the year Dr Mike O'Sullivan presented on behalf of ORSNZ at the APORS Webinar, part of IFORS webinar series. He presented on joint work with A/Profs Ilze Ziedins, Cameron Walker on COVID-19 spread modelling and its effect on the healthcare sector. This work was later recognised as part of the research by a larger team on New Zealand's COVID-19 response with the entire team winning New Zealand's Prime Minister's Science Prize for 2020. ORSNZ did not hold a conference in 2020 after its council showed a preference for local, shorter events. However, uncertainty re: lock-downs and a more general "hunkering down" due to the pandemic meant that no events were organised for the end of 2020.

OR Society of Philippines (ORSP)

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As with the rest of the world, 2020 was an uncharacteristic year for the Operations Research Society of the Philippines (ORSP). Though it was not able to carry out its regular annual activities, ORSP conducted a pre-APORS online conference (September 23 – 25, 2020). The APORS Conference was scheduled to be hosted by the Philippines in 2021. With the postponement of the Triennial IFORS 2020, the society made an early decision to give way to the conference which was to be held in Korea, a fellow APORS member.

The first of the 3-day online conference featured speakers from the four regions of IFORS, namely North America (NORAM) represented by Karla Hoffmann; Latin America (ALIO) by Andres Weintraub; Europe (EURO) by Grazia Speranza; and Asia-Pacific (APORS) by Simon Dunstall. National paper presentations were given by Michael O' Sullivan, Operations Research Society of New Zealand (ORNZ); Hannah Johns, The Australian Society for Operations Research (ASOR); Zulkifli Mohd Nopiah, Management Science/Operations Research Society of Malaysia (MSORSM);

The second day was contributed by various member societies of APORS, such as, Sim Cheng Hwee, Operations Research Society of Singapore (ORSS); Ziyan Luo, Operations Research Society of China (ORSC); Marie Shella T. Mariscal, Operations Research Society of the Philippines (ORSP); Yong-Hong Kuo, Operational Research Society of Hongkong (ORSHK); Aldy Gunawan (ORSS); Vijay Chandru, Operational Research Society of India (ORSI); Tatsuo Oyama, The Operations Research Society of Japan (ORSJ); Govinda Tamang, Operational Research Society of Nepal (ORSN); Nezam Mahdavi-Amiri, The Iranian Operations Research Society (IORS); Hyun-Soo Han, The Korean Operations Research and Management Science Society (KORMS); Nita H. Shah (ORSI); Urmila Pyakurel (ORSN); Semini Wijekoon, The Australian Society for Operations Research (ASOR); and DongDong Ge (ORSC). The third day featured contributed papers and a tutorial session.

The Board also welcomed two new members to its fold, bringing its composition to the 50-50 split between academe and practice. The year was also spent in organizational activities for the upcoming 2022 APORS conference.

Report of the Vice President representing EURO

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The European regional grouping within IFORS, EURO (The Association of European Operational Research Societies), currently consisting of 32 member societies, has had a very productive year 2020.

In 2020 the 33 working groups associated with EURO were actively promoting their fields of research. Members of a working group regularly exchange ideas and results, support each other's research work, publish their findings, and organize seminars or conferences. An example would be the yearly ORAHS-conference organized by the same-named working group and devoted entirely to OR-topics in healthcare. In 2020 the conference took place virtually in Vienna, Austria (webpage). As another example, the working groups can act as (co-)organizers of EURO Mini Conferences.

The scientific results of the year 2020 generated by the researchers associated with EURO and its working groups are captured in the four EURO journals, among others: European Journal of Operational Research (EJOR), EURO Journal on Computational Optimization (EJCO), EURO Journal on Decision Processes (EJDP), and EURO Journal on Transportation and Logistics (EJTL). The latter three have now become Open Access. More information on the EURO journals can be found online on the EURO webpage.

The most recent events related to the CoViD-19 pandemic have, of course, also impacted EURO. Conferences, working group meetings, and education programs have been either canceled or postponed to a later date. The EURO Ph.D. School, for example, is an initiative established for post-graduate education for Ph.D. students under a school format. Initially, there were two EURO Ph.D. schools planned for 2020. One was planned to occur in Seville, Spain, and to be dedicated to data-driven decision-making and optimization. The other was planned to take place in Ankara, Turkey, and to be dedicated to MCDA/MCDM. Unfortunately, both had to be postponed to 2022 due to the pandemic. EURO supports the attendance of young European scholars in ELAVIO (Escuela Latinoamericana de Verano en Investigación Operativa) conferences (the 2020 ELAVIO was planned to be held in Peru but had to be rescheduled to 2021). EURO further supports Ph.D. students interested in participating in the National Taught Course Centre in Operational Research (NATCOR), which delivers taught courses in the UK.

The EURO Summer and Winter Institutes (ESWI), another EURO education initiative, are meant to give early-stage researchers an opportunity for scientific exchange with other researchers of their field. The next EURO Institute will take place from the 28th of May until the 10th of June 2022 in Edinburgh, UK. For more information on ESWI and all previously mentioned EURO education initiatives, see the EURO webpage.

A new initiative, the EURO WISDOM Forum (Women In Society: Doing Operational Research and Management Science), has been created and has held three webinars in 2020 (see EURO WISDOM).

In conclusion, 2020 was a very successful and productive year for the entire EURO association and all its members. Now, we summarize the events of the beginning of 2021 and provide an outlook on activities planned for the rest of the year.

There is one change to the Executive Committee of EURO compared to 2020: The new President is now Marc Sevaux, who has replaced Immanuel Bomze, who now serves as Past President after his successful term as President in 2019 and 2020. The Association is further administered by Vice President (VP) 1 Prof. Joanna Józefowska, VP 2 Prof. Julia Bennell, VP 3 Prof. Claudia Archetti, Secretary Prof. Jesper Larsen, Treasurer Prof. Marino Widmer, and IFORS Vice-President Prof. Stefan Nickel (for details see https://www.euro-online.org/web/pages/1456/executive-committee).

EURO is supported by additional Officers who have specific responsibilities and administrative roles: Manager Dr. Sarah Fores, Executive Assistant and Website Editor Diane Wilson, Information Technologies Manager Prof. Bernard Fortz, and Advisor to EURO-k Conferences Prof. Gerhard-Wilhelm Weber (cf. https://www.euro-online.org/web/pages/1598/euro-officers).

However, despite the rather difficult current situation, EURO activities have not come to a complete halt. The EURO WISDOM Forum has already held its first webinar. Another example is the EURO 2021 conference in Athens, Greece, which will take place from the 11th until the 14th of July. Planning and preparations are already running in full swing!

Report of the Vice President representing NORAM

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The North American Research Societies (NORAM) is made up of two societies: The Canadian Operations Research Society (CORS) and the Institute for Operations Research and the Management Sciences (INFORMS). Activities of the two societies for 2020 as well as planned events for 2021 are reported below. Both societies have been extraordinarily active given the pandemic. Instead of simply cancelling events, both societies had their annual events done remotely and sponsored other activities to keep their membership informed during these difficult times.

CORS ACTIVITIES.

The Canadian Operational Research Society (CORS), a.k.a. Sociéte Canadienne de Recherche Opérationnelle (SCRO) (www.cors.ca) is the leading Canadian professional society for operational researchers. Established in 1958, CORS brings together OR professionals with annual conferences held across Canada, special interest groups, traveling speakers' programs, and student support. CORS sponsors the INFOR journal and also publishes the Bulletin, a newsletter of the Society and related activities. It is administered by a Council of eleven members.

Meetings.

The COVID-19 pandemic has impacted all operations research societies and CORS is no exception. The CORS 65th National Meeting that was to be held in Toronto in June 2020 was rescheduled and will be held entirely virtual in June, 2021. The plenary speakers for the conference include: **Susan Athey**, Economics of Technology Professor at Stanford Graduate School of Business; **Anna Nagurney**, John F. Smith Memorial Professor in the Department of Operations and Information Management I the Isenberg School of Management at the University of Massachusetts, Amherst will give the Harold Larnder Memorial Lecture on "Novel Supply Chain Network Models Inspired by the COVID-19 Pandemic; and **Georgia Perakis**, William F. Pounds Professor of Management and Codirector of the Operations Research Center at the MIT Sloan School of Business. The conference will feature presentations, plenaries and tutorials and will provide opportunities for online networking and live interaction with the attendees. There will be a live awards ceremony and the Canadian Healthcare Optimization Workshop (CHOW) will be held in parallel and will focus on emerging topics in healthcare. For more about this meeting, please visit: https://www.cors2019.ca/.

On October 30, 2020 CORS held its first microevent which was organized by the HCOR SIG on the topic of Machine Learning and AI in Healthcare, chaired by Majid Taghavi. On November 27, 2020, the CORS Council organized the event "New OR PhDs" featuring a set of short submitted research talks from graduating PhD students together with a round-table discussion. More virtual events are planned for 2021.

Awards.

The following 2020 awards will be presented at the 2021 CORS Annual Conference. They include:

- **Anna Nagurney** as the **Harold Larnder Prize,**
- **Canadian Tire** is the recipient of the **Omond Solandt Award**
- **David Stanford** will be presented with the **Award of Merit** and
- **The Award of Merit** recipient is **David Stanford**
- **Margarita Castro** (University of Toronto) received First Prize int the **CORS Student Paper Competition Open Category**
- **Sarah McCurdy, Meghan Stronach, Allison Jacobs, and Alyssa Hopkins** (University of Waterloo) received the **CORS Student Paper Competition Undergraduate Category:** First Prize
- **Sarah McCurdy, Meghan Stronach, Allison Jacobs, and Alyssa Hopkins** (University of Waterloo)
- **Mona Imanpoor Yourdshahy** (University of British Columbia) won **The Queueing Theory SIG Student Paper Prize**

Publications. CORS publishes the journal **INFOR,** a quarterly journal on Information Systems and Operational Research (**Samir Elhedli and Elkafi Hassini**, Editors in Chief) whose goal is to publish research at the intersection of data analytics, Operations Research computational intelligence and optimization. It also publishes the **CORS Bulletin** (**Andrea Friars**, Editor)

INFORMS ACTIVITIES.

INFORMS (www.INFORMS.org) promotes best practices and advances in operations research, management science, and analytics through an array of highly-cited publications, conferences, competitions, networking communities, and professional development services.

Meetings:

As with most societies, the COVID-19 pandemic has impacted INFORMS' activities this year. INFORMS normally holds two major conferences each year: The 2020 INFORMS Annual Meeting (scheduled to be held in person in the Washington DC area), was held as a virtual meeting. The attendance, for this meeting, mainly oriented towards academics, was quite large (over 5000 people attending virtually) with the entire program available to registrants for over 3 months after the meeting. The 2021 meeting is scheduled for October 2021 as a hybrid in-person and virtual meeting. The Analytics Conference, which is always held in the spring for practitioners took place in May, 2020 also in a virtual format and the 2021 Analytics Meeting was held in April, also a virtual meeting. Many of the special interest meetings have also been postponed, gone virtual or been cancelled. The 2020 INFORMS conference on security was held in February in Monterey, CA prior to the pandemic and the 15th INFORMS Telecommunications and Network Analytics Conference was held virtually. Most other conferences were postponed until 2021.

For 2021, the following meetings are planned: The 2021 Virtual INFORMS Regional Analytics Conference – Seattle will be held in May (virtual), the HealthCare 2021 will be held in July (virtual), and the 2021 INFORMS Regional Analytics Conference – Chicago (virtual) will be held in September.

Publications:
INFORMS publishes 16 journals, and three newsletters (OR/MS Today, Analytics and a student newsletter). INFORMS also a number of research series publications including, *Editor's Cut, TutORials in Operations Research,* and *Topics in Operations Research.*

Subdivisions:
In addition, INFORMS has various subdivisions directed at members of the OR/MS community including 12 Societies, 23 sections and 4 for a. There are also 65 regional and student chapters.

Awards:
The following prize winners for 2020 include:

- **The Daniel H. Wagner Prize for Excellence in Operations Research Practice was awarded to Saurabh Bansal, Genaro J. Gutierrez, Mahesh Nagarajan** for their work on using optimization for Portfolio Management in Agribusiness;
- **The Doing Good with Good OR - Student Paper Competition** was awarded to **Emma Gibson**, Massachusetts Institute of Technology;
- **The Don P. Gaver Junior Early Career Award** was presented to **Philip Ernst**, Rice University;
- **The George B. Dantzig Dissertation Prize** was given to **Nikhil Garg**, Stanford University;
- **The George E. Kimball Prize** was awarded to **Grace Lin**, IBM T.J.Watson Research Center;
- **The George Nicholson Student Paper Prize** was awarded to **Ryan Cory-Wright** , Massachusetts Institute of Technology and **Jean Pauphilet**, Massachusetts Institute of Technology;
- **The Frederick W. Lanchester Prize** was awarded to **Peyman Mohajerin Esfahani**, **Professor TU Delft and Daniel Kuhn**, Professor of Operations Research at the College of Management of Technology at EPFL;
- **The INFORMS President's Award** was given to **Cynthia Barnhart**, Massachusetts Institute of Technology;
- **The INFORMS Prize** was awarded to **Amazon**;
- **The Impact Prize** was awarded to **David Simchi-Levi**, MIT Operations Research Center;
- **The John von Neumann Theory Prize** was awarded to **Adrian S. Lewis**, Cornell University;
- **The Judith Liebman Prize** was awarded to **Hyame Alameddine**, Concordia University; **Sebastian Barriga**, Pontificia Universidad Catholica de Chile; **Wesley Marrero**, University of Michigan;
- **The Moving Spirit Award for Fora** was awarded to **Dorothee Honhon**, University of Texas at Dallas;
- **The Saul Gass Expository Writing Prize** was awarded to **Sheldon H. Jacobson**, University of Illinois at Urbana-Champaign;
- **The Volunteer Service Prize** was awarded to: D**ayana Warren Hearnes**, Cardlytics; **Sheldon H. Jacobson**, University of Illinois at Urbana-Champaign; **Col William K. Klimack**, United States Military Academy; **Jack Levis**, UPS; **Shantih Spanton**, CSX and **Julie L. Swann**, Georgia Institute of Technology, School of Industrial & Systems Engineering;
- **The Undergraduate Operations Research Prize** was awarded to **Wes Gurnee**, Cornell University;
- **The UPS George D. Smith Prize** was given to the **University of Iowa, Department of Business Analytics**;
- **The Prize for the Teaching of OR Practice** was given to **Susan Martonosi**, Harvey Mudd College, Department of Mathematics;
- **The INFORMS Case Competition** was awarded to **Dessislava Pachamanova**, Babson College; **Vera Tilson**, University of Rochester; and **Keely Dwyer-Matzky**, University of Rochester Medical Center and Golisano Children's Hospital;
- **The Franz Edelman Award for the Achievement in Operations Research and the Management Sciences** was awarded to **Intel**;

In addition, the following people were inducted as INFORMS Fellows in 2020:

- **Susan Alban**, Professor, Industrial Engineering, Rutgers University;
- **Saif Benjaafar**, Department of Industrial and Systems Engineering and Director of the Initiative on the Sharing Economy, University of Minnesota;
- **Manoj Chari**, Director of Data Science, Otis Elevator Company;
- **David Goldsman**, Director of Master's Programs and Professor, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology;
- **Oleg Gusikhin**, IoT and Analytics Innovation Technical Leader, Ford Motor Company;
- **Illya Hicks**, Professor in the Department of Computational and Applied Mathematics, Rice University;
- **Jionghua (Judy) Jin**, Professor, Department of Industrial and Operations Engineering, Director of Manufacturing Program of Integrative Systems and Design Division, University of Michigan;
- **Janny Leung**, Professor, Choi Kai Yau College, University of Macau;
- **Nelson Maculan**, Professor of Optimization Department of Systems Engineering and Computer Science, Federal University of Rio de Janeiro;
- **Glenn Wegryn**, Executive Director, University of Cincinnati Center for Business Analytics;
- **Assaf Zeevi**, Professor, Graduate School of Business, Columbia University;
- **Stefanos Zenios**, Professor of Entrepreneurship and Professor of Operations, Information, and Technology, Stanford University;

Applying OR to Optimise the Delivery of Cash to ATMs in Guatemala

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Background

Guatemala has the largest economy in Central America and Banking is one of its healthiest sectors. A consolidation process during the late 90s achieved a dramatic reduction from 38 banks via mergers or acquisition to only 17 as of today, and this triggered many efficiency projects. For example, a five bank alliance produced a common brand operation of ATM services, called 5B, which now manages some 2,500 ATMs all over the country. These require cash replenishment at regular intervals and this relies on the services of companies who deliver cash to and from cash machines at periods agreed by the banks involved.

In contrast to the ATM alliance, cash transportation services remained at that time under an oligopoly of two major international companies, which used to negotiate price agreements with each other, within regulations, to avoid entering price wars, and they dominated cash transportation services for some years; excessive price increases were common. The companies' operational model dictated the cash transportation business model: the price formula included the visit unit cost per number of visits, and the amount of cash moved per insurance cost, plus an expected margin. Banks usually negotiated service packages that would try to limit budgetary overflows by fixing a certain number of visits at a price with a discount. Bank managers sought to avoid budgetary crisis since cash transportation had become among the three larger operational cost accounts for banks.

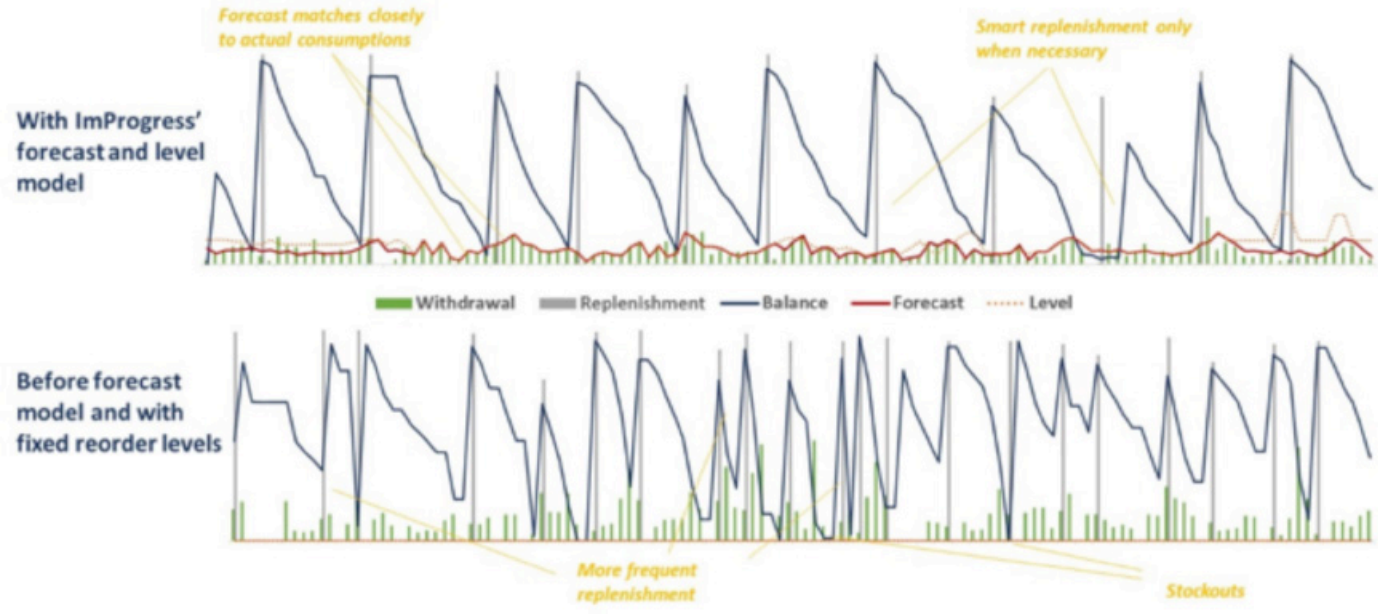
The technical problem to be tackled

By the end of 2014, a local entrepreneur in the phone card market and guard security services began to compete in the cash transportation market. His company, TAVSA, "Transporte y Administración de Valores, S.A." erupted in the marketplace, although the possibilities for a new and small company to compete in these conditions were truly slim. He was certain that the development of a new business model could compete successfully in the sector, and to develop a winning business strategy he raised three questions:

1. Should the company enter the market with the same price formula, or should it develop a new one?
2. What was the minimum operational size to arrive at a breakeven point in the shortest possible period?
3. How to find the differentiated customer value proposition to compete and gain market share as fast as possible?

The consultancy study

TAVSA decided it needed help with tackling these questions and wished to find innovative consultants who had the operational experience to develop this new business model to impact dramatically the market in a traditional business environment. Improvement & Progress* (I&P) was selected as it had gained considerable experience over 7 years designing and implementing optimized replenishment models for ATMs. It had used an innovative stochastic model to determine a daily forecast of the cash demand for every ATM using Bayesian Theory and probabilistic distributions to determine which ATMs needed replenishment and the optimal moment to do so, the number of cassettes to be used and the number of cash notes to be dispatched.



▲ Figure 1 - Comparison between Optimal ATM Replenishment Methodology vs Traditional Replenishment

The primary aim of the model was to reduce the number of visits to ATMs by the cash transportation companies (see Fig.1). The outstanding success of applying this stochastic model resulted in the firm obtaining other projects with several banks and increasing its experience and understanding of the key operating levers of the business model. Leonte Pallais, current CEO of 5B, describes the importance of these mathematical models for his company. "We based the operational core of our company on the efficiency produced by the mathematical tools implemented by Improvement & Progress".

For TAVSA, the challenge was to create a new improved business model that could compete meaningfully with a well-established business operation dominated by two international companies in a traditional business environment averse to risk and failure. TAVSA appointed I&P in 2015 to develop the desired innovative new model.

I&P's first aim was to maximize the Customer value proposition. This was achieved by searching for an important job-to-be-done that was poorly satisfied for the customer and subsequently devising and developing an offering that could do the job better than alternatives at the lowest appropriate price. It was found that that there was a poor alignment of interest between the banks and the transportation companies: in relation to ATMs, banks wanted to have the maximum number of transactions at the minimum cost, and the cash transportation companies were looking to maximize the revenue by increasing the visit price or the number of visits. The latter dilemma became the opportunity for TAVSA to break into the market. After discussions and brain storming sessions, I&P staff asked: What would happen if a new cash transportation company offered to align its revenues to the number of transactions performed at each ATM instead of to the number of visits? If transactions increased, the cost to banks would increase directly, but if transactions decreased, the cost would also decrease directly, maintaining the unit cost for banks. This was very attractive to them. At the same time, TAVSA was able to offer lower prices since the new operational model allowed TAVSA to become more efficient cost-wise as a result of larger volumes, synergies and control of the forecasting process and the cash movement decisions.

The traditional operational directives to perform cash replenishment of ATMs were that 5B used the forecasting model, developed by I&P, to determine visit needs and send daily instructions. The latter would take some time to arrive at the cash transportation companies, which would then integrate them with the rest of the requests, adapting plans and routes. These operational restrictions limited the possibilities for optimization. I&P concluded that if 5B would delegate the forecasting and visits planning to TAVSA, I&P's mathematical model could determine which ATMs to visit, when, and with how much cash. Then, the firm could reduce the time of response, increase the uptime of the ATMs related to cash, minimize the number of visits or the number of traveled kilometers and the number of vehicles used to replenish the ATMs. The operational and financial outcomes could be dramatically better than those of the competition.

The model and outcome

Using the forecasting model on a daily basis, a certain number of ATMs were selected for replenishment. The aim was to use the minimum number of cassettes per ATM, which would also minimize the use of the cash fund prepared for ATMs replenishment. The model calculated the minimum number of cassettes necessary to fulfill the forecasted demand using the following linear programming model:

$$\textbf{Objective:} \quad \min c^T x$$
$$\textbf{Subject to:} \quad a_1^T x = b_1;\ a_2 x \leq b_2;\ x \geq 0$$

$\mathbf{X}$: Number of cassettes over the minimum to replenish each ATM

c^T: Cost related to travel time from the operations centre to the ATM to be replenished.

Cash Fund Restriction

a_1^T: All-ones vector

b_1: Available fund over the minimum for ATM replenishment, expressed as number of cassettes

Capacity Restriction

a_2: Identity matrix

b_2: Capacity of additional cassettes over the required minimum for each ATM

The second part of the model was to integrate a Travelling Salesman Model as follows:

of all the ATMs in a clustered region, the shortest route is calculated to replenish them using armoured vehicles. The model uses different algorithms to calculate different options and then select the best option. For example: Nearest neighbor, Nearest Insertion, Arbitrary Insertion, etc.

Miller–Tucker–Zemlin Formulation (see Ref 2)

$$\min \sum_{i=1}^{n} \sum_{j \neq i, j=1}^{n} c_{ij} x_{ij}$$

x_{ij}: Route between ATMs i and j ; c_{ij}: Distance between ATMs i and j

Subject to:

Exit Restriction

There must be only one exit per city;

Arrival Restriction

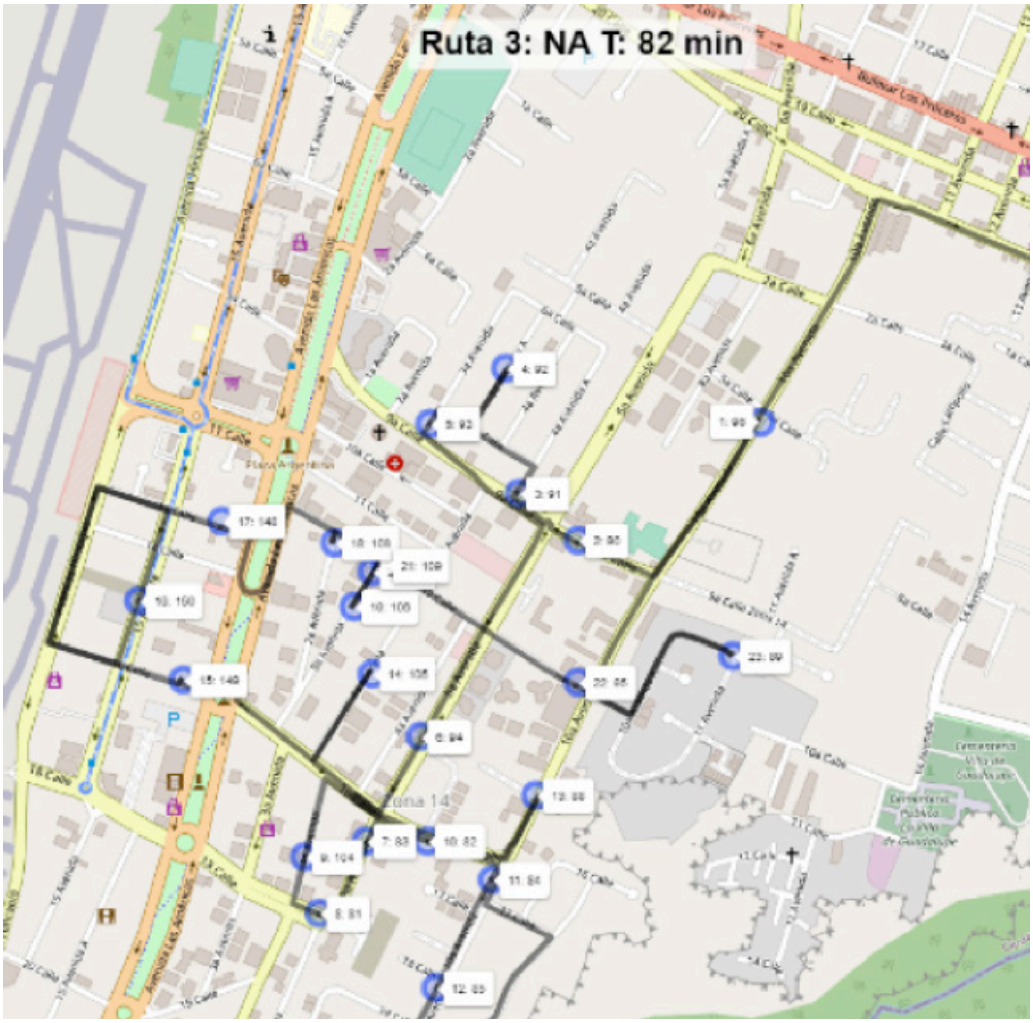
There must be only one arrival per city

Unique Route Restriction

u is a dummy variable of the order of the Route, created to satisfy the restriction which guarantees replenishment of all necessary ATMs

Outcome

In a few weeks, using the above LP solution and the best algorithm selection developed in R language, I&P minimized on paper the number of visits, the number of travelled kilometers, increased the uptime, and minimized the amount of cash used to replenish the ATMs.



▲ Fig 2 An optimized route

The second step (using Johnson's framework - see ref 1) was to develop a profit formula, ie an economic blueprint that defines how the company will create value for itself and its shareholders. This specifies the assets and fixed cost structure, as well as the margins and velocity required to cover them. In developing the formula the firm had the great help and experience of TAVSA in former businesses to determine accurately key processes, resources, costs, margins, and recovery speed. This process also took some weeks to discuss and prepare scenarios, which could help determine the optimal transaction price which would make the company competitive.

TAVSA's CEO then negotiated with 5B the new business model and economic conditions. They agreed to delegate forecasting and cash management to TAVSA, and signed a new contract. The thorough implementation of the new business model allowed the company to achieve top results in all areas.

Client comments

Miguel Ángel Sánchez, TAVSA's CEO explains "This new business model helped us achieve the best indicators of all three companies in all areas. Minimum transportation cost per ATM, cash amount needed to replenish the ATMs, maximum uptime related to cash replenishment, led to us becoming the most confident cash transportation service provider of the country. This translated into a current 80 percent market share, which is an incredible leap for a small national company in only 5 years. TAVSA has become the largest cash transportation company in Guatemala, managing currently all of the ATMs under the administration of 5B".

Without a doubt, grasping value through innovation based upon operational efficiency is, with limited exceptions, a way to compete and dominate the market.

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* Improvement & Progress is a small consultancy firm founded by two former teachers at the Operations Research Masters Program of Galileo University in 2004. The author of this article is one co-founder. The company currently has some 20 employees, mostly professionals with a master's degree in Operations Research or Business Intelligence, nourished under the wing of Dr Jorge Samayoa, Director of the Operations Research Institute of Galileo University, and by Commercial Engineers from Francisco Marroquin University.

Karush-Kuhn-Tucker Conditions

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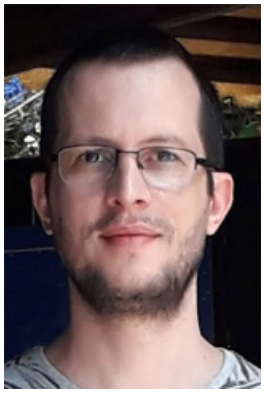


Introduction

Let us consider the constrained nonlinear programming problem (NLP)

$$\text{minimize } f(x) \qquad (\mathrm{P})$$
$$\text{subject to } x \in \Omega \subset \mathrm{R}^n$$

where

$$\Omega = \{x \in \mathrm{R}^n \mid h(x) = 0,\ g(x) \le 0\} \qquad (1)$$

is the feasible set. We assume that $f : \mathrm{R}^n \to \mathrm{R}$, $h_i : \mathrm{R}^n \to \mathrm{R}, i=1,\ldots,m$, $g_j : \mathrm{R}^n \to \mathrm{R}, j=1,\ldots,p$ are continuously differentiable functions in an open set containing Ω. For each $x \in \Omega$, $A(x) = \{j \mid g_j(x) = 0\}$ is the set of indexes of active inequality constraints.

A local minimizer of (P) is a feasible point x^* such that $f(x^*) \le f(x)$ for all feasible x closer to x^*. Solving (P) consists in find such points, but this is not possible in practice since it involves the evaluation of f in an uncountable set. Thus, it is suitable to deal with computationally verifiable conditions that describe some property satisfied by every local minimizer x^*. These are the *(necessary) optimality conditions*.

A good optimality condition should be easy to verify and strong as possible. In this sense, "$x^* \in \mathrm{R}^n$" and "x^* is a local minimizer" are not adequate: the first does not describe well local minimizers, while the second is too hard to check. To obtain useful conditions, we should consider the behavior of f and the structure of the feasible set Ω whenever possible. In this context, a key fact is that for every local minimizer x^* of (P), the objective function f does not decrease locally by moving along feasible directions. This geometry can be characterized by using the rich theory of cones.

For a general NLP with inequality and equality constraints, we consider the cone of *tangent directions* of Ω at x

$$\mathcal{T}(x) = \left\{ d \in \mathbb{R}^n \mid \exists \{x^k\} \subset \Omega : x^k \to x,\ x^k \neq x,\ \frac{x^k - x}{\|x^k - x\|} \to \frac{d}{\|d\|} \right\} \cup \{0\}.$$

$T(x)$ includes all directions for which small movements from x result in feasible points (*feasible directions*). Another cone is that of *descent directions*, which consists of directions in which f decreases locally, $V(x)=\{d \in \mathrm{R}^n \mid \exists\ \varepsilon>0 : f(x+td)<f(x), t\in(0,\varepsilon]\}$. However, due to the difficult in dealing with $V(x)$, it is common to consider the restricted simple set

$$\mathcal{D}(x) = \{d \in \mathbb{R}^n \mid \nabla f(x)^T d < 0\} \subset \mathcal{V}(x).$$

Therefore, the following necessary condition for local optimality is intuitive: if x^* is a local minimizer of (P) then

$$\nabla f(x^*)^T d \ge 0 \ \text{ for all } \ d \in \mathcal{T}(x^*), \qquad (2)$$

which is equivalent to $\mathcal{D}(x^*) \cap \mathcal{T}(x^*) = \emptyset$. Another convenient way to write (2) is

$$-\nabla f(x^*) \in \mathcal{T}^\circ(x^*), \qquad (3)$$

where $C^\circ = \{y \in \mathbb{R}^n \mid y^T d \le 0,\ \forall d \in C\}$ is the polar of set $C \subset \mathbb{R}^n$. See Figure1(a) on P.17.

Condition (2) gives an authentic criterion to check if a feasible point is not a local minimizer of (P), but $\mathcal{T}(x^*)$ is still difficult, perhaps impossible, to compute. As we have already mentioned, we want to obtain a practical and computable condition. Taking advantage of the algebraic description (1) of Ω, we consider the linearization of Ω at x.

$$\mathcal{L}(x) = \{d \in \mathbb{R}^n \mid \nabla h_i(x)^T d = 0,\ i = 1,\ldots,m;\ \nabla g_j(x)^T d \le 0,\ j \in A(x)\}.$$

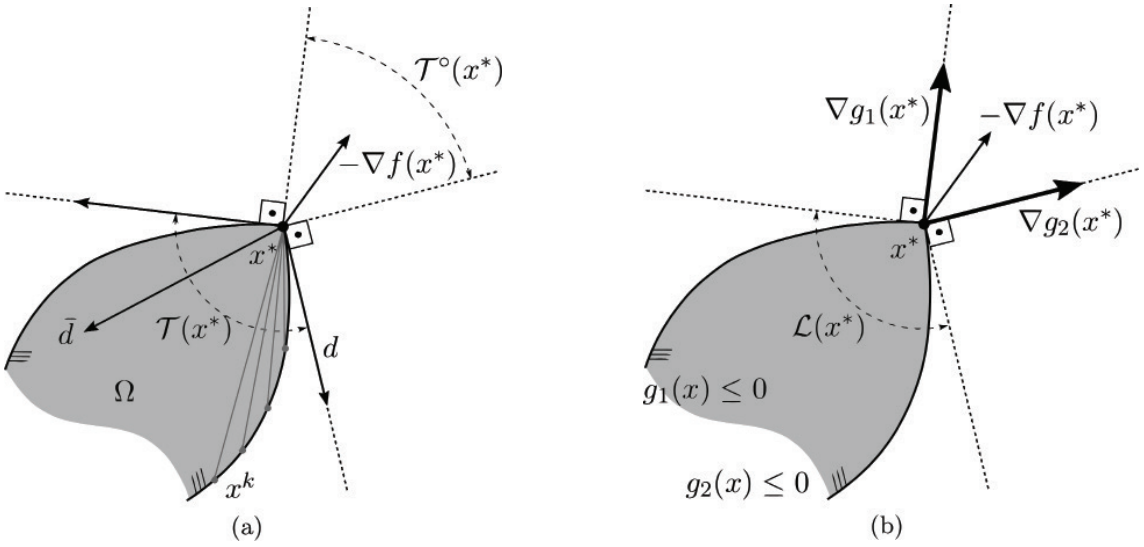
See Figure 1(b). Note that only active constraints are present, since the inactive ones do not affect Ω locally around x. Also, note that the linearized cone $\mathcal{L}(x)$ is computationally tractable since it involves only the point x and a system of linear equalities/inequalities. It is straight forward to verify that $\mathcal{T}(x) \subset \mathcal{L}(x)$ for all $x \in \Omega$, but the contrary inclusion may not happen (for example,if $\Omega=\{x\in\mathrm{R} \mid x^2 =0\}$ then $\mathcal{L}(0)=\mathrm{R} \not\subset \{0\}= T(0))$. So, we can not change in principle $T(x^*)$ by $\mathcal{L}(x^*)$ in (2) without an additional assumption, otherwise there may exist local minimizers that do not fulfil the resulting property. Nevertheless, besides its simplicity, $\mathcal{L}(x^*)$ gives the following useful property:

Theorem 1. If $x^* \in \Omega$ satisfies $\nabla f(x^*)^T d \ge 0$ for all $d \in \mathcal{L}(x^*)$ then there exist scalars $\lambda_1,\ldots,\lambda_m,\mu_1,\ldots,\mu_p$ such that

$$\nabla f(x^*) + \sum_{i=1}^{m} \lambda_i \nabla h_i(x^*) + \sum_{i=1}^{p} \mu_i \nabla g_i(x^*) = 0, \qquad (4a)$$
$$h(x^*) = 0,\ g(x^*) \le 0, \qquad (4b)$$
$$\mu_i \ge 0,\ \mu_i g_i(x^*) = 0, \quad i = 1,\ldots,p. \qquad (4c)$$

Theorem 1 can be proved by the Farkas lemma. In fact, it can be stated that $\mathcal{L}(x^*)$ is equal to the polar of the cone generated by the gradients of active constraints [3], or equivalently, that

$$\mathcal{L}^\circ(x^*) = \left\{ \sum_{i=1}^{m} \lambda_i \nabla h_i(x^*) + \sum_{i=1}^{p} \mu_i \nabla g_i(x^*) \,\middle|\, \mu_i \ge 0,\ \mu_i g_i(x^*) = 0,\ i = 1,\ldots,p \right\}.$$



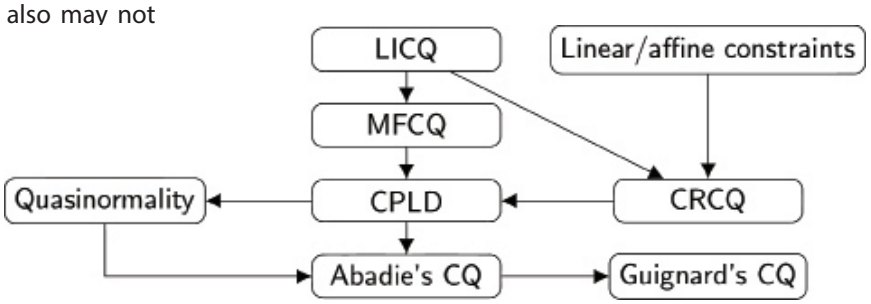
▲ Figure 1: . (a) $d, \bar{d} \in \mathcal{T}(x^*)$ The direction d is tangent, while, in addition, $\bar{d}$ is feasible. We have $-\nabla f(x^*) \in \mathcal{T}^\circ(x^*)$, and it is not possible to decrease f along $d\mathcal{T}\in (x^*)$ maintaining feasibility; (b) $\mathcal{L}(x^*)$ is the cone of directions that do not make obtuse angles with $\nabla g1(x^*)$ or $\nabla g2(x^*)$.

Expression (4) is known as *Karush-Kuhn-Tucker (KKT) conditions*. The vectors $\lambda \in \mathrm{R}^m$and $\mu \in \mathrm{R}^p+$ are called *Lagrange multipliers.* The origin of KKT conditions dates back to 1939 with the unpublished master's dissertation written by Karush. They were rediscovered in 1951 in an independent work of Kuhn and Tucker. Curiously, Karush's work remained forgotten for several years. See [5]. KKT is one of the most important concepts in non-linear continuous optimization; it also has been specialized for many particular important classes of problems, such as multiobjective, Nash equilibrium problems and even for non-smooth optimization.

We stress that (2) or (3) may not occur at a local minimizer with $\mathcal{L}(x^*)$ instead of $\mathcal{T}$ (x^*). In turn, conditions (4) also may not occur at local minimizers. For example, $x^* = 0$ is the (unique) minimizer of $f(x) = x$ subject to $x^2 = 0$, but in this case (4a) requires that $1+0\cdot\lambda = 0$, which is impossible. Nevertheless, Theorem 1 (i.e., KKT conditions) gives a suitable way to decide if a point x^* is a good candidate for local minimizer of (P). In fact, several practical algorithms (perhaps all) for constrained optimization aim to reach points satisfying (4). So, it is reasonable to consider hypotheses under which changing $\mathcal{T}(x^*)$ by $\mathcal{L}(x^*)$ in (2) or (3) still provide a necessary optimality condition. Due to the nature of $\mathcal{L}(x)$, such assumptions act on the constraints, and then they are called *constraint qualifications* (CQs). Two obvious CQs are $\mathcal{L}(x^*) = \mathcal{T}$ (x^*) and $\mathcal{L}^0(x^*) = \mathrm{T}^0(x^*)$, which are known as Abadie's CQ and Guignard's CQ, respectively. In time, Guignard's CQ is the weakest hypothesis in the sense of it ensures that x^* fulfils (4) for all smooth functions f that has x^* as local minimizer [4]. Many others CQs were proposed in the literature. Among them, we highlighted the most common in classic books such as [3, 6], the *linear independence of the gradients of the active constraints* (LICQ):

$$\nabla h_i(x^*),\ i = 1, \ldots, m,$$
$$\nabla g_j(x^*),\ j \in A(x^*) \quad \text{are linearly independent.} \qquad (5)$$

It is well known that LICQ implies the uniqueness of Lagrange multipliers. Some other CQs in the literature are: linear/affine constraints (all h_i's and g_j's affine); Mangasarian-Fromovitz CQ – MFCQ (the only linear combination of (5) equal to zero with nonnegative ∇g_i's coefficients is the trivial); Quasinormality (a hypothesis associated with external penalty methods); Constant Rank CQ – CRCQ (each subset of gradients in (5) linearly dependent at x^* remains linearly dependent around x^*); and Constant Positive Linear Dependence CQ – CPLD (a generalization of CRCQ to nonnegative linear combinations). See [1, 2]. Figure 2 summarizes the mentioned CQs. It is worth mentioning that they are not exhaustive. See [1] and references therein.



▲Figure 2: Some CQs and their relationship. An arrow indicates an implication.

With one of these additional hypotheses, conditions (4) provided the important practical characterization of local minimizers of (P):

Theorem 2. *If x^* is a local minimizer of (P) and satisfies some CQ of Figure 2, then x^* is a KKT point, that is, x^* fulfils* (4).

Supposing a *priori* the validity of some CQ, the practical implication of Theorem 2 is that if an algorithm converges to a point $x^*$for which there are vectors λ and μ satisfying (4), then x^* is a good candidate for local minimizer. Based on this, several methods has been proposed such as external penalty strategies, augmented Lagrangian schemes, sequential quadratic programming and interior point methods. See [6].

We finish with a brief comment on the recently introduced sequential optimality conditions, which are characterizations of minimizers by means of limits of sequences. The goal of such conditions is two-fold: on the one hand, they are satisfied by minimizers of (P) without the necessity of any constraint qualification, such as LICQ; on the other hand, they are associated with the sequences generated by practical algorithms. This means that the behaviour of an algorithm can be treated regardless of the fulfilment of any CQ. Furthermore, when compared to KKT, sequential optimality conditions provide very general CQs based on the continuity of associated set-valued maps. See [1] and references there in.

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OR IMPACT

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Physician Rostering in a Large Brazilian Hospital During Covid-19 Pandemic

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Project overview

Hospital de Clínicas de Porto Alegre (HCPA) is a public hospital linked to the Federal University of Rio Grande do Sul (UFRGS). HCPA is located in Porto Alegre, the capital of the southernmost state of Brazil. HCPA is among the largest hospitals in Brazil, tending to more than half a million patients per year. It is seen as a hospital in south Brazil to which cases needing highly complex medical treatment are referred. In terms of numbers, the hospital has more than 6000 employees , with almost 200 Intensive Care Unit (ICU) beds, 110 of which were allocated to Covid-19 patients in April 2021. About 600 of them are physicians, and currently 90 of them work in the ICU.

Constructing physicians' work schedules (also called rosters) is a difficult and recurring task in hospitals, and often highly qualified professionals such as doctors and nurses are assigned to carry out this task manually. Despite taking a considerable amount of time and effort to produce, the final rosters are frequently unsatisfactory.

In July 2016, the first meetings concerning a research project with the aim of automating the generation of physicians' rosters took place at HCPA. The project's scope was defined by listing several requirements that must be met to automate the generation of the rosters for the ICUs areas. The ICU areas are divisions of the ICU beds according to several specialties (pediatric, cardiac, among others) or according to physical spaces (eight out of the current 14 areas are for Covid-19). Through intensive collaboration with the hospital professionals, several constraints were identified, and included in the problem model. Examples include restrictions regarding the maximum working time per day, week or month; minimum and maximum number of physicians per day/shift/area; a physician can be unavailable for some shifts or days; a physician must be qualified to work at specific areas; minimum and maximum number of assignments on non-business days; >>

>> maximum number of monthly assignments on weekdays; equal day and night working hours during weekends; complete weekend (a physician ideally works both Saturday and Sunday or none), and many others. Rosters are provided for each month. For some constraints it was essential to consider assignments from previous months, such as the number of weekends a physician is on duty across multiple months. To enable this, historical data was compiled and used as input when generating a new roster. Once a roster is computed, it in turn serves as historical data for the next rostering period.

▲ **Figure 1:** Hospital de Clínicas de Porto Alegre (HCPA) Photo Credit: HCPA

Rules and restrictions in the problem that must be satisfied were modelled as hard constraints, while physicians' preferences were modelled as soft constraints. Soft constraints were organized in three layers of importance, with each layer characterized by a different cost associated with preference violations.

A mathematical model was first solved using the open-source solver Coin-OR CBC. Later, in an effort to address larger instances of the problem, a matheuristic algorithm was also proposed. In April 2019, the automated rostering algorithm was implemented in a software package which we named *ProScheduleSolver*, and was deployed at the ICU areas of HCPA. Since physicians can work in different areas, rosters cannot be generated independently per area, making the problem harder to solve. The software was registered by the university and licensed to HCPA. The implementation of *ProScheduleSolver* as well as its communication with existing hospital IT infrastructure makes exclusive use of third-party technologies and frameworks which were available as open-source software.

In addition to the optimized schedule, the software also presents statistics regarding the generated solution, enabling an easy comparison between physicians' allocations. For example, it is necessary to ensure a fair distribution of working hours during day and night shifts as well as during non-business days.

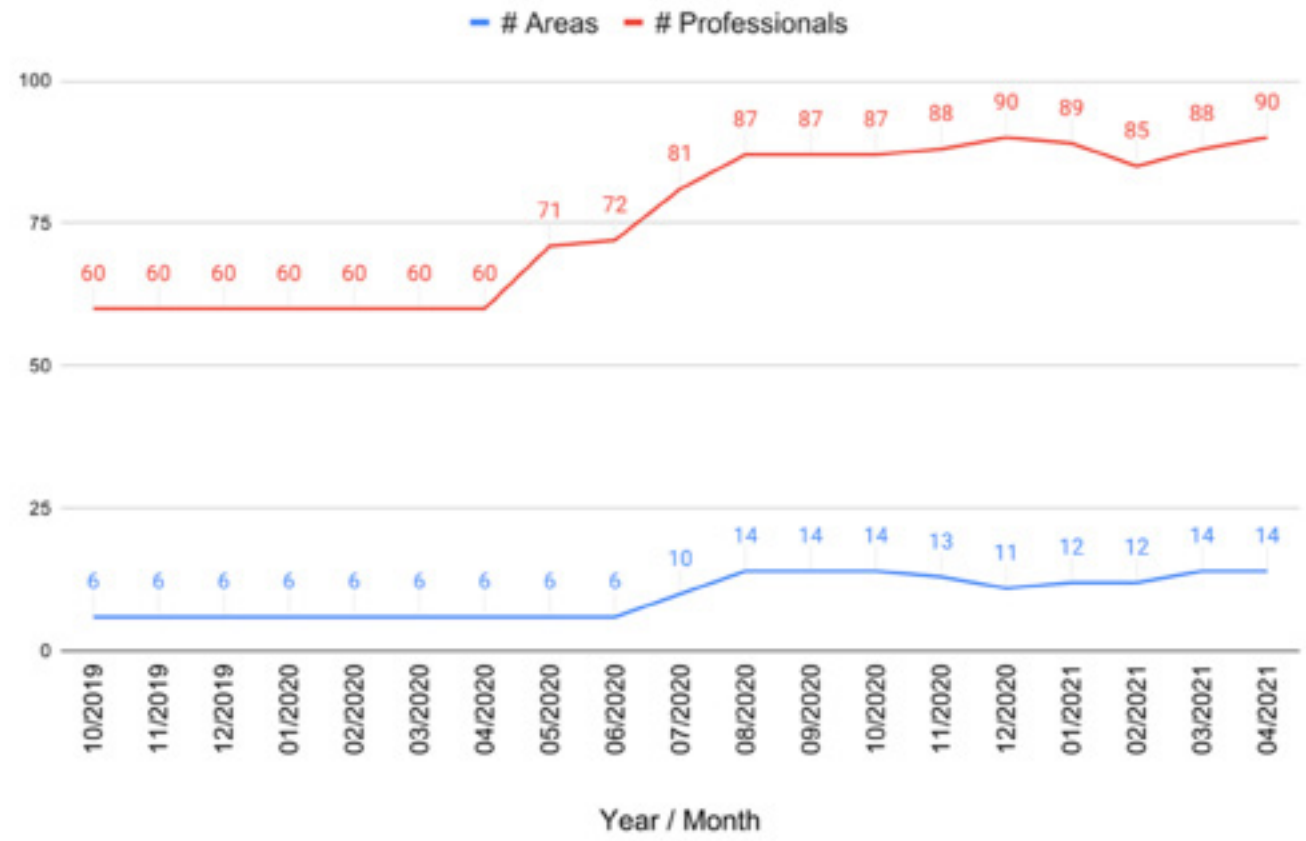
Analysing the whole process, we concluded that from the operational research side, it was important to have quick and effective responses (providing solutions, adding/adjusting constraints, or discussing constraints raised by the physicians). From the hospital side, it was important to consider the expertise of the person who had provided the manual roster for several years, and also to have full support of the hospital management, who were willing to adopt an automated solution.

Covid-19 and the demand for healthcare professionals

The already difficult task of organizing the ICU roster became even more challenging with the arrival of the Covid-19 pandemic. As in many other hospitals around the world, the ICU at HCPA (Figure 2) has been flooded with Covid-19 patients. Figure 3 illustrates the number of physicians working in the ICUs (red line) as well as the number of different ICU areas in HCPA (blue line). There is a clear increase in both starting in May 2020, which is when the first wave of Covid-19 hit Porto Alegre.

▲ **Figure 2:** Intensive care unit during the Covid-19 pandemic. Credit: HCPA

The developed automated rostering approach played an important role in organizing the physicians' rosters during this high-demand period. The hospital was able to contract new ICU physicians, but several positions were left empty due to the shortage of these. The challenge, therefore, was to organize the available resources in the best possible way. Due to the increase in the number of physicians in ICUs by about 50% in comparison with the period pre-pandemic, it was nearly impossible to construct the rosters by hand and on time.



▲ **Figure 3:** Red - Number of physicians in the ICUs and Blue - number of different ICU areas at HCPA.

The head of the ICUs at HCPA, the physician Fabiano Nagel, publicly stated that ``**The software made it possible to quickly and effectively provide the rosters during the pandemic. With more areas and physicians, it would be impossible to provide the rosters manually.**"

Several benefits were obtained by using the proposed solution:

• **Time:** the average time to prepare a roster reduced from days to a few hours.

• **Feasibility:** Rosters no longer violate any of the hard constraints, in contrast to the manual rosters.

• **Cost:** Overtime decreased by 24.7%, saving costs for the hospital.

• **Fairness:** now physicians have a similar workload on weekends and nights shifts, for example.

•**Transparency:** There was no statistical data on manual rosters, creating uncertainty regarding fairness in allocations.

Footnote: Roster robustness and re-rostering

The considerable increase in workload that healthcare systems are currently facing due to the Covid-19 pandemic, places immense pressure on hospital staff. In many cases this leads to an increased level of absenteeism, leaving shifts understaffed and hospital managers searching for ad hoc replacements. Often, shift assignments must be changed or in some cases physicians have to be called in from their day off. One way of minimizing the impact of these re-rostering methods is to construct robust rosters which are less sensitive to disruptions.

We have developed different approaches to robust rostering. We have evaluated how two types of buffer increase robustness and how the degree of robustness of a roster may be estimated using an analytical approach which does not require simulation. The two types of buffer we considered are capacity buffers, which assign more physicians than the minimum required, and reserve duties, which designate a certain number of physicians to be on standby and capable of being called into the hospital at any moment.

People involved

This work was part of Toni Wicket's PhD under the supervision of Luciana Buriol in Brazil, and Greet Vanden Berghe and Pieter Smet at KU Leuven in Belgium, being a joint PhD of UFRGS (Brazil) and KU Leuven (Belgium). Toni was, and remains, a member of the IT group of HCPA. PhD student Alberto Kummer helped to implement the Solver while Toni was in Belgium. Márcio Boniatti was the physician responsible for generating the rosters manually until 2016 and was instrumental in terms of helping to define and evaluate the effectiveness of the proposed solution method. Toni's thesis was classified as the third-best PhD thesis in computer science presented in Brazil in 2019, as recognized by the Brazilian Computer Science Society. Moreover, the software *ProScheduleSolver* ranked second place at the *24º Concurso Inovação no Setor Público do Brasil,* which is the main national prize concerning innovative solutions in Brazilian public institutions.

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IFORS Global Webinar Report by AFROS OR in AFRICA – Promising Developments

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The African Federation of OR Societies (AFROS) was delighted to be invited recently by Grazia Speranza (IFORS President) and Rosiane de Freitas (Chair of IFORS Developing Countries Committee) to take part in IFORS' Global Webinar series, which aims to showcase good OR from different regions of the world. For recordings of this, and previous webinars in the series from North America, Asia Pacific, Europe, and Latin America, see www.ifors.org/ifors-global-webinar-series/

After a few weeks' preparation, with much support from IFORS' support staff (Mary Magrogan and Christy Blevins) and several African universities, AFROS' webinar took place on March 29th, 2021. It was attended by 72 keen OR people from nine different African countries with others coming from as far afield as the Philippines and Brazil.

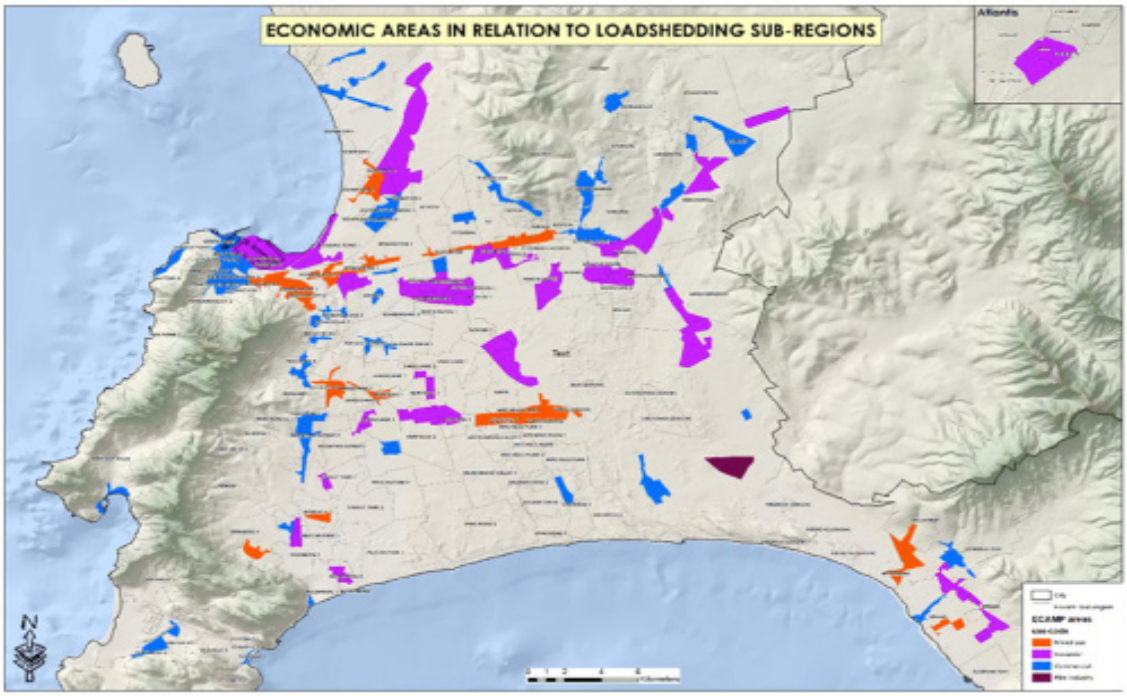
A summary of the event follows.

Mary Magrogan (IFORS Secretary) gave a short introduction, then the President of IFORS, **Grazia Speranza**, welcomed participants and introduced **Hatem Masri**, the President of AFROS.

Hatem thanked her for the opportunity to showcase African OR and enthusiastically outlined AFROS' beginnings and the work that it was doing to encourage the development of OR Chapters, Working Groups and National Societies across Africa. The African dream started in Kenya five years ago and the kickoff took place in Tunisia in 2018 with the first AFROS conference. The second AFROS conference will be hosted alongside the South African OR Society (ORSSA) conference in South Africa in 2021 to celebrate 50 years of annual meetings of the ORSSA. Hatem expressed the determination of the AFROS executive committee members to expand its network and to promote analytics in Africa.

Sue Merchant then introduced the three AFROS speakers from North, West and Southern Africa.

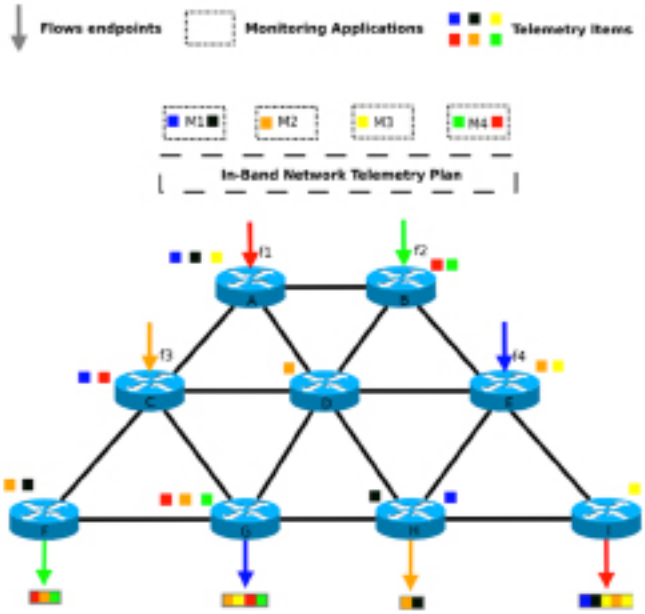
Georgina Rakotonirainy, originally from Madagascar but now working in South Africa at the University of Cape Town, gave the session's first talk about her work from a few years ago of designing optimal electricity power outage schedules taking area allocation fairness into account. South Africa at that time was experiencing many power shortages because of production difficulties and the consequent need to periodically cut off electricity to parts of the country to avoid complete blackouts. Georgina developed two mathematical programming models (ILP and MILP) with the objectives of achieving the desired level of power reduction and minimising the economic cost of the cuts while maximizing the allocation fairness to customers: i.e. it aimed to avoid shedding power in successive time slots for an area as well as balancing the average number of times a particular area had power shed in a period. Georgina showed us some of her interesting results and pointed out that a fair schedule is likely to come at the cost of negative economic impacts.



▲ Georgina's slide

Jules Degila, from the University of Abomey-Calavi in Benin, spoke next about his work on 'Orchestrating the In-Band Data Plane Network Telemetry.' He explained that Telemetry is an automated process by which measurements and other data are collected at remote points and transmitted to receiving equipment for monitoring and that 'Network Telemetry' refers to the newer network data collection and consumption techniques. Inband Network Telemetry items are embedded into production data and different flows that are either determined in advance or during the optimization process. Several problems are associated with such measurement, e.g. how and where the measurement is made affects the network differently and leads to different formulations of the problem. The objectives are to maximize the numbers of collected items that meet the monitoring applications' requirement. Jules presented their first model's results compared to those based on a GRASP heuristic, and said the work would benefit telecommunications operators with networks and Network Operating Centres spanning multiple countries with limited capacity satellite segments. He concluded that it would increase international network visibility while minimizing the required bandwidth and thus the costs.

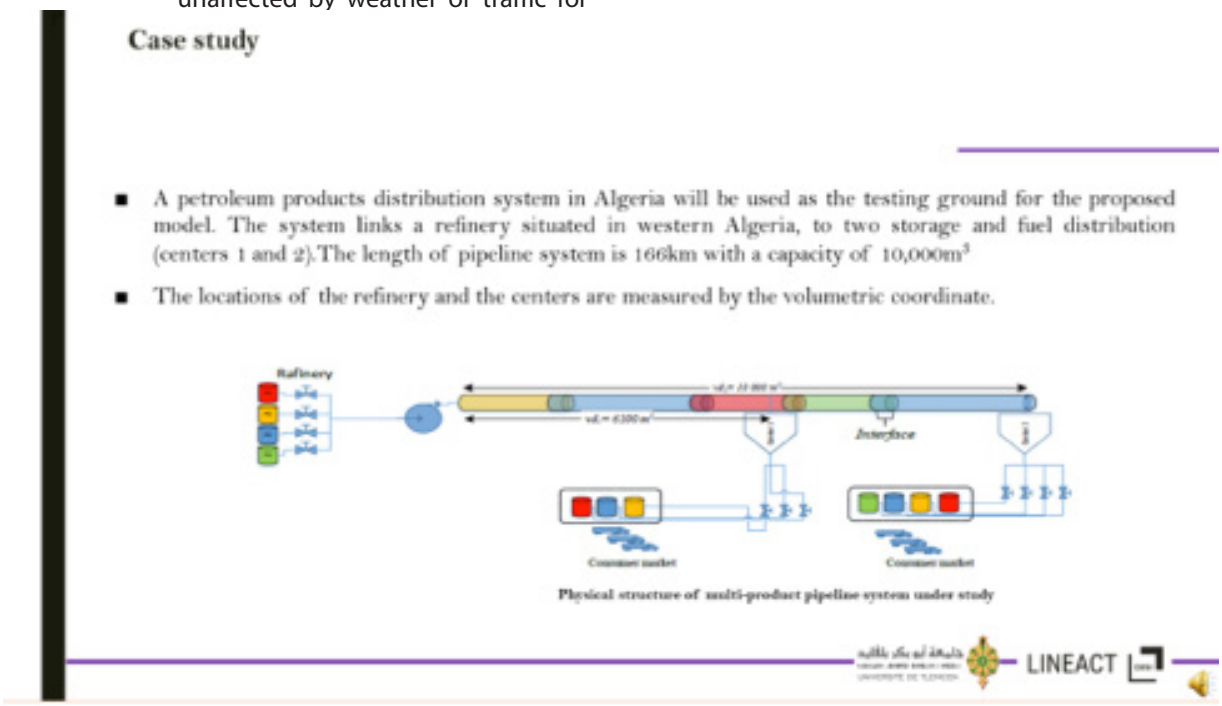
Our final speaker, **Wassila Abdellaoui**, from the University of Tlemcen, Algeria, described to us her case study on the optimal scheduling of a multi-product pipeline in the downstream oil industry. Oil products (e.g., gasoline, aviation fuel, diesel, and petroleum) form a large part of the Algerian economy. The pipelines are the preferred mode of distribution as they are safe, operate round the clock and are unaffected by weather or traffic for



▲ Jules' slide

example. Different products are often pumped back-to-back in a pipeline, so some mixing occurs and hence degradation of the products. Optimisation techniques are needed to find the most feasible and efficient batch schedules which meet demand. Wassila explained how her model (which uses the MILP method) minimizes the operating cost (which is made up of pumping and contamination costs) subject to a range of constraints, such as the need to meet delivery requirements. She tested her model, which utilizes CPLEX for coding and solving, on a real pipeline 166km long and capacity 10K m3, and found it produced results in 3.76 mins. The work can now be extended to multi-product pipelines with many objectives and random demand.

All three speakers answered a few questions at the end of the presentations and were thanked for their very hard work and most interesting talks. The presentations can now be viewed on IFORS website see IFORS Global Webinar Series – IFORS, Operations Research, Operational Research, Management Science



▲ Wassila's slide

5th International Week at the Prague University of Economics and Business–good atmosphere and cheer, in despite of the pandemic

Veronika Brunerová <veronika.brunerova@vse.cz>

Prague University of Economics and Business (VSE) is the biggest university in the fields of economics and business in the Czech Republic and was founded in 1953. The university has 6 faculties and nowadays about 14.000 students. We offer *bachelor, master* and *PhD* study programmes, which are taught mainly in Czech and English languages. For closer information please visit https://www.vse.cz/english/. Faculty of Informatics and Statistics of the Prague University of Economics and Business *(VSE)* organizes every year, usually in January, International Weeks where several foreign experts in various fields offer lectures for the students of the VSE. In 2021, this event took place during January 18-21. The main organizer is the Faculty with his Dean *Professor Jakub Fischer* and Vice-Dean for International Relations *Professor Petr Doucek*.

The university is highly appraised both in the Czech Republic and in abroad, and it received many international accreditations. *VSE* is ranked by the *Financial Times* annually and has already been classified for several years by the *Eduniversal Ranking* project as one of the best *"business schools"* in Central and Eastern Europe.

The internalization is a big issue of higher education. The internalization is a big issue of higher education and the university supports any activities that raise the level of co-operation in this field. VSE organizes or supports the organization of international conferences, workshops, summer schools, and other events. From the area of operations research, it is possible to mention a successful *EURO 2007, 22nd European Conference on Operations Research* in Prague, with more than 2000 participants. We have every year more and more foreign students enrolled to our English and also Czech taught programs, every year we accept about 700 exchange students at *VSE*, and we send a similar number of students to abroad for "mobility" studies.

We are a team from one of the faculties of *VSE*, from the *Faculty of Informatics and Statistics*. Our faculty is a little bit different to other faculties at VSE. We offer study programmes related to IT, applied informatics, information management, econometrics, data analysis. These all fields are highly demanded on the job market. In Prague nowadays, and it seems that the coronavirus will not change the situation significantly, are many firms and companies looking for our students and graduates. Most of our Master students are working part-time already during studies. For that reason we are facing the problem to persuade our students, to leave the country for one semester and go for Exchange Mobility. They are usually afraid to leave their jobs and interrupt their starting career. Also the financial issue is significant.

Therefore we decided to organize *International Weeks*. Every year in the same time we invite guest teachers from our partner universities to us, to Prague, to give here lectures in English. The courses are recognized by students as elective courses for 3 ECTS. And they are open to all students at *VSE*, especially recommended to Master´s students from our faculty. So, we allow our students to experience "mobility" at *VSE*, without the necessity to leave Prague. Of course, it is not a "full-simulation", but at least a special experience offered to our students. They have the possibility to meet teachers from partner universities, experience other teaching methods, and practice their English. And it also works like a motivation to applying for the real Exchange Mobility in future, to encourage them.

5th International Week 2021 at VSE Prague: logo, content and poster.

We organized the *1st International Week* in January 2017. At that time we just wanted to try it and invited first three guest professors. In the meantime, our event has a five-year tradition already. Every year we invite 6-8 guest lecturers at every third week in January. In recent two years we cooperated with other faculties from *VSE*, with the *Faculty of Finance and Accounting* and with the *Faculty of Economics*. Together we invited the teachers, cared for them, organized their working contracts in the Czech Republic, and prepared some social activities for the event.

The courses are usually from the following fields: information technology, data science, Operational Research, statistics, econometrics, finance and accounting.

During our *5th International Week* during Monday 18 - Thursday 21, January 2021 (cf. https://fis.vse.cz/english/events/iweek/), we offered the following courses:

"Information for Business", taught by *M Sirajul Islam* from the Örebro University in Sweden;*"Operational Research and Finance in Times of Changes",* lectured by *Gerhard-Wilhelm Weber (Willi)* from Poznan University of Technology, Poland; *"Enterprise Architecture Modelling",* given by *Małgorzata Pańkowska* from the University of Economics, Katowice, Poland; "*Project Team Management of tomorrow",* held by *François Kaisin,* professional certified business coach and founder of the Morena Coaching International, and teacher at the University of Nice, France; *"Quantitative Risk Management",* taught by *Marcin Fałdziński* from Nicolaus Copernicus University in Toruń, Poland; and *"Accounting for sustainability",* lectured by *Lina Dagiliene* from Kaunas University of Technology, Lithuania. There were 177 students involved into these diverse courses.

This year the event was extraordinary. Because of the COVID restrictions we had to organize all courses online, via platforms *MS Teams* and *ZOOM*. Teachers stayed at home and just joined to the courses and students virtual. Of course, we missed the possibility to meet the teachers in person, to show them our beautiful city and invite them for some beer after the lectures. However, the epidemic situation has to be survived, and hopefully our next international week - the *International Week* in January 2022 - will be held as usual.

If you are interested to read more information on our *International Week,* or to take part at this even, please visit our webpage of the faculty (https://fis.vse.cz) or contact the *International Week Team* via me at veronika.brunerova@vse.cz. It is a great experience and possibility to visit a beautiful historical city of Prague.

This novel form of a conference was a wonderful success, as one of the teachers, *Willi*, testifies. He is very grateful to the *Prague University of Economics and Business (VSE)* and notably to the team which organized the *5th International Week* with such a great care that covered all the lettering, preparation and processing of contracts, didactical thoughtfulness at the side of the lecturers, setting-up and running of the online teaching system, briefing and training of the lectures, and guiding and supporting them in every respect during their dense schedules at all of the conference days. In his lectures on *"Operational Research and Finance in Times of Changes",* the students were very much interested and attentive, cheerful and successful. He especially thanks *Dr. Veronika Brunerová,* coordinator of English-taught programs at the Faculty of Informatics and Statistics of *VSE* for her devoted, friendly and tasteful service to us all for about one year, and *Prof. Dr. Josef Jablonsky,* Head of Department of Econometrics of *VSE*, who proposed *Willi* as a speaker at those unforgettable days in Prague and "online".

Pandemic Times in Italy: When AIRO and AIROYoung Decide to Go Online

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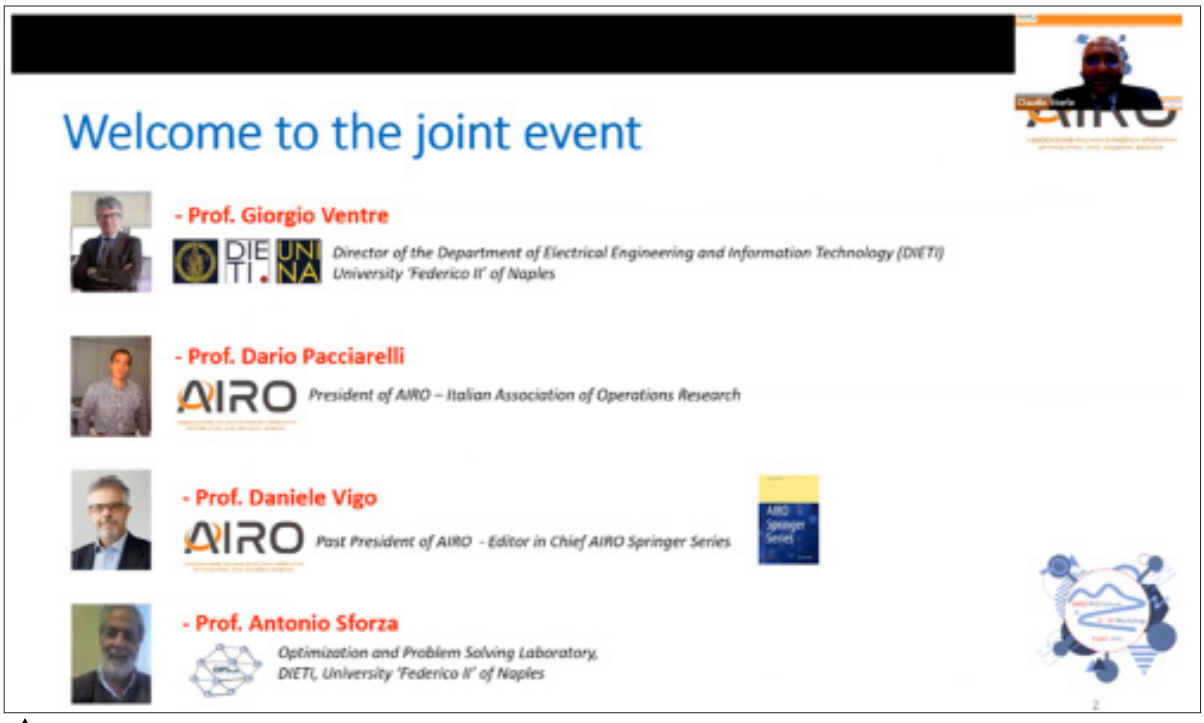
The *"AIRO PhD School 2021 and 5th AIROYoung Workshop"* on *"Optimization and Data Science: Trends and Applications",* joint event of the *Italian Operational Research Society (AIRO)* [1] and the *Young Researchers Chapter of AIRO (AIROYoung)* [2], was held online on the February 8-12, 2021. The joint event was initially planned to be held in a blended form. The physical venue would have been the Conference Room of Physics and Mathematics Science Academy in Naples (Italy) [6], one of the main historical buildings of the University of Naples. However, due to the pandemic and related restrictions, the event was run only in virtual form on ZOOM communication platform with the support of Springer. The Organizing Committees of both events worked together in order to deliver, also under the current circumstances, a high-quality experience for all participants. On one hand, the PhD School Committee was supported by the *Operations Research Group of the Department of Electrical Engineering and Information Technology of the University "Federico II" of Naples (Maurizio Boccia, Antonio Sforza* and *Claudio Sterle)*. On the other hand, there were representatives of *AIROYoung Veronica Dal Sasso* (Optrail), *Adriano Masone* (University "Federico II" of Naples), *Andrea Mancuso* (University "Federico II" of Naples) and *Valentina Morandi* (Free University of Bozen/Bolzano).

▲ Homepage of the *Joint Event.*

The event attracted more than 350 researchers and practitioners from 33 countries, within Europe and outside, up to USA, Brazil, India and New Zealand, thus showing its strong international character. We are thrilled by this result, as it shows that the interest in our discipline is strong, but usually mitigated by geographical distances.

▲ The *5AYW* Organizing Committee (from top to bottom: *Veronica Dal Sasso, Adriano Masone, Andrea Mancuso, Valentina Morandi*).



▲ *Joint Event:* Special speeches during the Opening Session.

The joint event program was structured into two consecutive parts. In the first part, the *AIRO PhD School 2021* (cf. second figure) provided a stimulating learning environment where participants got opportunities to develop research skills and increase their knowledge base. In particular, the PhD School featured five lectures given by outstanding scientists: *Maria Grazia Speranza* (Department of Economics and Management, University of Brescia, Italy), *Antonio Frangioni* (Department of Computer Science, University of Pisa, Italy), *Michele Monaci* (Department of Electrical, Electronic and Information Engineering, University of Bologna, Italy), *Manlio Gaudioso* (Department of Computer Engineering, Modeling, Electronics and Systems, University of Calabria, Italy) and *Stefano Lucidi* (Department of Computer, Control, and Management Engineering, University "La Sapienza" of Roma, Italy).

In the second one, the 5th edition of the *AIROYoung Workshop (5AYW)* featured two high-quality lectures, held by *Alberto Ceselli* (Department of Computer Science, University of Milan) and *Ivana Ljubic* (ESSEC Business School, Paris), an invited session by Lottomatica of IGT Italia and 35 talks held by the participants. We have been particularly pleased by the considerable number of contributed talks coming from different countries and covering many research subjects: from theoretical results and innovative methods to applications, as well as Transportation, Machine learning for Healthcare, Non-linear Optimization and Variational Analysis. This shows *AIROYoung*'s continuous intention of experimenting interactions between *OR* and other research communities, such as researchers in machine learning and data science.

We take this opportunity to thank again all the lecturers and speakers for their great contribution. All the material, including the slides and the videos of the lectures, and the abstracts of the talks, can be found on the event website [3].

▲ Group picture at the *5AYW*.

The *5AYW* also proposed a special session dedicated to some of our sponsors: Actor, Circle, Kantar, Optit, Optrail and Springer. Each of them had the chance to present itself to the community and show that *OR* is applied also outside academia to optimize the world around us. It is very important, in our opinion, to show these opportunities to fresher *OR* researchers. First, they can have an overview of the industry *OR* job market and improve their network. Secondly, it highlights the importance of *OR* which is not always under the industry spotlights contrary to the closely related Machine Learning and Data Science.

AIROYoung always reserves a special attention to students with few available funds organizing fee-free events and providing grants to partially cover the participant expenses.

This year, the whole joint event was free and, being it online, three grants were established for the three best presentations in the form of accommodations for the next, our *6th AYW*. The winners of the grants were (in alphabetical order): *Gabriele Dragotto, Daniel Faccini* and *Bernardo Martin Iradi*. A special mention goes also to *Riccardo Giusti* and *Edoardo Scalzo* for the high quality of their talks.

The workshop was also the occasion to present the newly appointed *AIROYoung* board, in charge until 2024: *Lorenzo Peirano, Alice Raffaele* (coordinators), *Veronica Dal Sasso* (treasurer), *Michele Barbato* (web curator), *Serena Fugaro* and *Giusy Macrina* (social media managers). We strive to build a network of passionate researchers in OR (cf. the fourth picture), and this cannot be achieved only by attending seminar sessions, but also organizing several social events. This year the challenge was even harder, but we were able to deliver social events too. The first was an aperitif, held on the platform *MIBO* [5], where the participants could chat while exploring an online tropical island. The second one, following the tradition of guided tours around the cities hosting the *AYW*, featured a brief guided tour of Naples filmed by the "local" organizers, followed by a collection of videos sent by the participants themselves, showing a particular spot of their hometown. *A true tour of the world!* In fact, not only active members of the *AIROYoung* community, but also participants from far away gave their precious contributions.

After the workshop, the participants could submit a short paper through the *Springer Online* Conference Service. Short papers will undergo a review process by anonymous referees. The *proceedings* will be collected as a special volume of the *AIRO Springer Series* [5], which focuses on the relevance of *OR* in the scientific world and in real life applications. Moreover, the best three papers will also be awarded with a grant for the *6th AYW*, in the same fashion of the ones given for the best presentations.

Now *AIRO* is looking forward to the next events, as *ODS2021* and the *6th AYW*, which we truly hope will take place also in presence.

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[1] AIRO, Associazione Italiana di Ricerca Operativa (AIRO). URL: https://www.airo.org.

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2] AIROYoung, AIRO Young Researchers Chapter. URL: https://www.airoyoung.org.

[3] AIRO PhD School 2021 and 5th AIROYoung Workshop. URL: http://opslab.dieti.unina.it/index.php/en/.

Controlling Processes and Operations - in Saint Petersburg and online - LII International Conference CPS 2021

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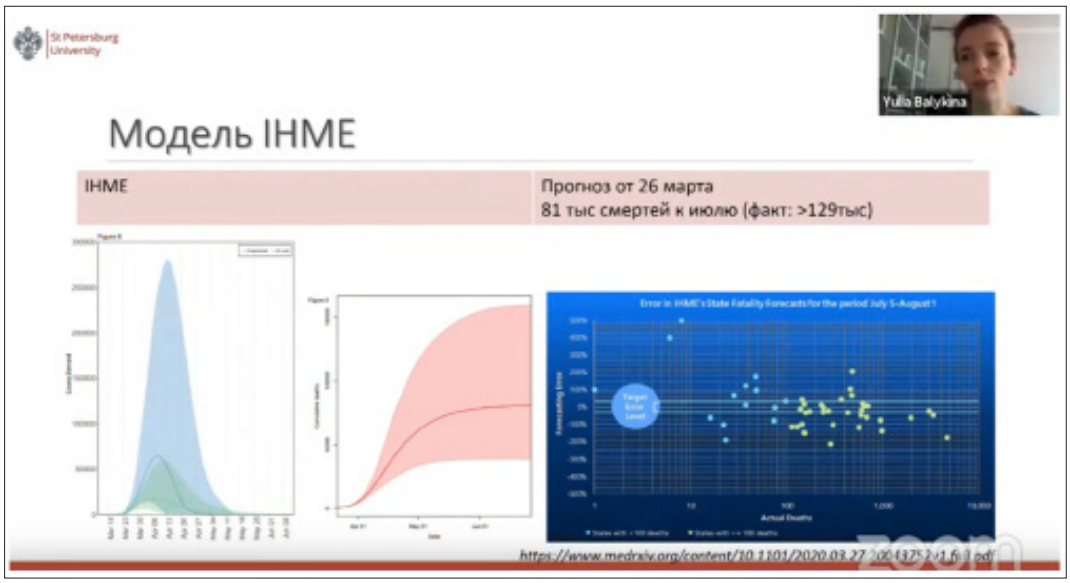
On April 5-9, 2021, the *LII International Conference "Control Processes and Stability" (CPS 2021)* was held at Saint Petersburg State University (https://english.spbu.ru/), Russia, in online format (http://cpsconf.ru/about/). The conference was organized with the support of *Saint Petersburg State University.*



▲ *CPS 2021:* Snapshot of the plenary lecture by *Prof. Yulia Balykina.*

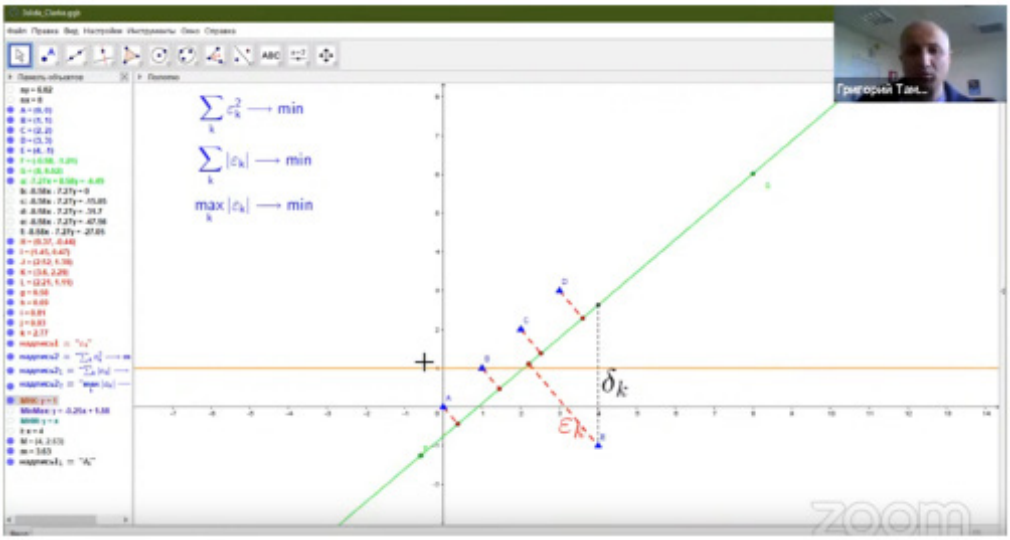
This has been the *52nd international conference* in the series *"Control Processes and Stability"* held at Saint Petersburg State University and before at Leningrad State University. It was a unique annual international conference on operational research, control problems, mathematical modeling and stability problems in Russia. The conference can also be called original because most participants were students and PhD students from different countries who presented their first scientific results. Many of the present professors of Saint Petersburg State University who work in this research area once presented their first results at this series of conferences.

The goal of the conference was to exchange the ideas in the field of operational research, control problems, mathematical modeling, stability and applications in various areas. One track at the conference was devoted to mathematical modeling and control problems in social sciences including economics, management and operational research.

According to our conference tradition, *CPS 2021* was organized under the guidance of a permanent international Program Committee chaired by *Prof. Leon Petrosyan* and *Prof. Nikolay Smirnov*. Two experts in mathematical modeling and applications were invited to *CPS 2021* as plenary speakers. They gave the following presentations: *"About constructive nonsmooth analysis"* by *Assoc. Prof. Grigoriy Tamasyan*, Saint Petersburg State University, and *"Spread of epidemics: in search of new models for forecasting practice"* by *Assoc. Prof. Yulia Balykina,* Saint Petersburg State University.

In total, 112 reports of 183 authors from 6 countries (China, Germany, Japan, Mexico, Russia, and Vietnam) were presented at the conference.

The conference proceedings have the status of a periodic scientific publication, ISSN 2313-7304. The materials of the proceedings will be posted in the database RSCI and in electronic library (E-library) [RSCI page https://www.elibrary.ru/title_about.asp?id=53121]. Archival materials of the conference since 2003 are posted on the website http://www.apmath.spbu.ru/ru/research/conference/pm/archive/



▲ *CPS 2021*: Snapshot of the plenary lecture by *Prof. Grigoriy Tamasyan.*

The proceeding of the conference will be published by summer 2021. The records of opening session, plenary talks and further talks presented at all sessions of the LII International Conference *"Control Processes and Stability" (CPS 2021)* are available on the official conference's YouTube channel: https://www.youtube.com/channel/UCDkebdp1sap6hTNrmvwh15A.

Stochastic Control and Operational Research Workshops: Aveiro, Portugal, and Toulouse, France: Online - worldwide conferences

Kerem Ugurlu <kerem.ugurlu@nu.edu.kz>

▲ *DCO2021:* Special moments from the conference (Retrieved from the official website).

My specialization in operational research and financial mathematics has started with my Ph.D. education at University of Southern California in collaboration with Cal-TECH. More specifically, focuses in my studies have been stochastic control theory and its applications in scenarios motivated by finance. After working some time as a postdoctoral research associate in the Computational Finance and Risk Management program at University of Washington and sharpening my computational skills as a data scientist in industry, I am currently working as an assistant professor of mathematics at Nazarbayev University, Kazakhstan. Based on my experience and interests, the two conferences that I am particularly interested in have been the *Dynamic Control and Optimization International Conference (DCO2021)*, which was held on February 3-5, 2021, that has taken in place Portugal on the occasion of *Professor Andrey Sarychev*'s 65th birthday [1] and *EUROPT 2021*, the 18th international workshop on continuous optimization taking place in Toulouse, France, between July 7-9, 2021. It was an honor to participate in *DCO2021* to meet scholars from different countries. The conference acted as a nice platform for sharing knowledge and ideas in the areas of dynamic control and optimization. My main motivation to attend was to deepen my knowledge and consider the concepts in this area from different perspectives, thus learning from my fellow counterparts, and to seek the opportunity to present my work to others in order to receive some feedback and learn some insights for improvement. This is exactly what *DCO2021* has offered to me.

It was a pleasure to see *Professor Andrey Sarychev* himself, from the Mathematics and Informatics Department of the University of Florence, in the honor of whom the *DCO2021* was organized. It is inspiring to observe how much contribution he makes in the fields of his interests by being the member of editorial committee of the *Journal of Dynamical and Control Systems*, collaborating with authors from different countries and bringing together academics in such thematic conferences as *DCO2021*. I especially would also like to thank *Professor Gerhard Wilhelm Weber* and *Prof. Tatiana Tchemisova* for introducing me to this conference and giving me the opportunity to contribute to this conference.

Even though it was unfortunate for an on-site event to be cancelled, the conference in online format surprisingly exceeded my expectations. In fact, it has been even more efficient in terms of logistics during the event since the attendees could easily switch between chat rooms anytime and listen to all the speakers we wanted to hear from. In my opinion, it would be beneficial to have next conferences in online format as well, regardless of the presence or absence of quarantine due to a pandemic situation. Firstly, as I mentioned, it is more efficient and convenient for the participants; and secondly, it saves a lot of time and money dedicated to its organization. Besides, it is probably easier and more convenient to record the discussions and presentations through such a ZOOM platform.
The idea of having some breaks for special activities in between the discussions also seemed appealing. The event became even more enjoyable with *Mr. Victor Castro*'s guitar performance, the famous guitar player of Portugal, and the nice book presentation made for the birthday of *Professor Sarychev.*

Overall, I was satisfied how the event proceeded, and it was engaging to participate in 11 Plenary Talks, namely: *"Control on the groups of diffeomorphisms"*, by *Professor Andrei Agrachev*, from Scuola Internazionale Superiore di Studi Avanzati, Italy; *"Obstacles to stabilization"*, by *Professor Yuliy Baryshnikov*, from University of Illinois at Urbana-Champaign, USA;

>> *"Ensemble controllability of quantum mechanical systems"*, by *Professor Ugo Boscain*, from École Polytechnique, France; *"Optimal bacterial resource allocation"*, by *Professor Jean-Baptiste Caillau*, from Université Côte d'Azur, France; *"Dynamics of distributed populations and its optimization"*, by *Professor Alexey Davydov*, from Vladimir State University and Moscow State University, Russia; *"Generalized convolutions, differential operators, and Lévy-like processes"*, by *Professor Manuel Guerra*, from Instituto Superior de Economia e Gestão, Portugal; *"Sub-Riemannian structures on homogeneous manifolds"*, by *Professor Fátima Silva Leite*, from University of Coimbra, Portugal; *"Necessary conditions and numerical methods for optimal control involving sweeping processes"*, by *Professor Maria do Rosário de Pinho*, from University of Porto, Portugal; *"Sufficient optimality conditions in Optimal Control"*, by *Professor Laura Poggiolini*, from University of Florence, Italy; *"Sub-Riemannian structures on Engel and Cartan groups"*, by *Professor Yuri Sachkov*, from Program Systems Institute of RAS, Perslavl-Zalessky, Russia; and *"Elementary geometry is dead. Long live (experimental) elementary geometry!"*, by *Professor Sergei Tabachnikov*, from Pennsylvania State University, USA. There were a lot of other interesting presentations, which offered a variety of perspectives and applications.

Two of my papers have been presented in this conference. One of them is on optimal control with so-called distorted probability distributions [2], whereas the second one is on the representations of evaluation operators, so-called risk measures, frequently used in actuarial and financial mathematics [3]. Specifically the first paper deals with a *robust optimal control* of discrete time Markov chains using probability distortion, which has many challenges intrinsically. To overcome these challenges, the problem is modified in a way that it can be solved by well-known methodologies, and the validity of my approach in a portfolio optimization problem is exemplified. The second paper focuses on studying so-called *Kusuoka representations* of so-called *coherent risk measures*. Roughly speaking, these representations have been refined in such a way that any coherent risk measure can be constructed and numerically implemented in an efficient way.

Along with *DCO2021*, the optimization workshop of *EUROPT 2021* also brings together experts from stochastic control and its applications in finance. Hence, it will be a great opportunity to meet these experts, share research ideas and see the beautiful Toulouse. *EUROPT 2021* is the annual event of the *EUROPT*, continuous optimization working group of *EURO (The Association of European Operational Research Societies)*. It will be hosted at ENAC (Ecole Nationale de l'Aviation Civile), the French National School of Civil Aviation. I would like to thank the organizing committee of this conference, especially to *Professor Sonia Cafieri*, for their hospitality in the organization procedure and the chairs of my session "Optimal Control and Optimization in Economics, Finance and Management", *Professor Gerhard-Wilhelm Weber*, *Ioannis Baltas*, and *Diogo Pinheiro*.

▲ *DCO2021:* The event's special guest, *Mr. Victor Castro* (Retrieved from the official website).

In this conference, I will present my paper on the *Merton Problem with drift uncertainty and priors* [4], examining a portfolio optimization problem and answering how the investor should distribute his/her wealth to maximize the final profit. The conference will be an excellent opportunity to share ideas for further research.

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[1] IFORS News, Vol. 16, 1, March 2021.

[2] "Optimal Control with Distorted Probability Distributions", K. Ugurlu and T. Brzeczek, http://www.optimization-online.org/DB_HTML/2020/07/7887.html.

[3] "Refinements of Kusuoka Representations", K. Ugurlu. http://www.optimization-online.org/DB_HTML/2020/06/7820.html.

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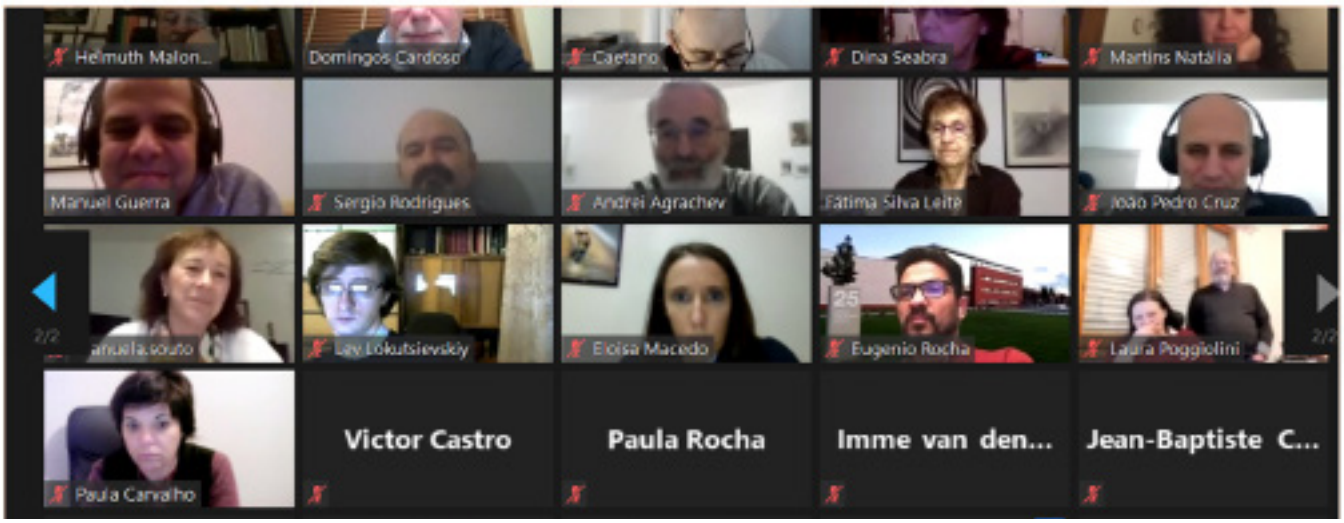

▲ *DCO2021:* Special moments from the conference (Retrieved from the official website).

EURO WISDOM Forum: YoungWomen4OR: "Facility Location Optimisation"

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▲ *EUROPT 2021:* The beautiful scenery of Toulouse (Retrieved from the official website).

The *EURO WISDOM (Women In Society: Doing Operational Research and Management Science) Forum* organized the *First YoungWomen4OR Webinar* via ZOOM on April 16, 2021. The event was in a bite-size format showcasing the research on facility location of one of the *EURO WISDOM YoungWomen4OR* awardees, *Dr. Mercedes Pelegrin Garcia*. This was paired with an insightful presentation on the current challenges and future research directions in OR for facility location provided by an expert in the field, also the *YoungWomen4OR* awardee, *Professor Ivana Ljubic*.

Dr. Mercedes Pelegrin Garcia, who is a Postdoctoral Researcher at Laboratoire d'Informatique of the École Polytechnique, France, discussed set-packing formulations in Facility Location. In particular, she described problem-specific facets, namely clique and hole inequalities. The related computational experience showcased the strength of these cuts, which can reduce the CPU times of a commercial solver in more than a half. Interesting connections between the presented facility location problems and haplotype phasing of diploid organisms were presented.

Ivana Ljubic is Professor of Operations Research at ESSEC Business School, Paris. She provided a short talk on Facility Location and Network Design in detailing the state of art and current challenges for the OR community in the field. Moreover, *Prof. Ljubic* briefly described the tools and methods of mixed integer (non-) linear programming, meta-heuristics and their successful combinations for solving optimization problems with applications to facility location and network design.

The webinar was organized by the *WISDOM* event subcommittee and moderated by *Paula Carroll*, the *EURO WISDOM* Chair. The presentations were followed by an open discussion, networking and a virtual coffee-break: about 30 attendees actively participated in this online event.

Future WISDOM Events

Next *YoungWomen4OR Webinar*: May 31, 2021, 15:00-16:00 (CET) with lightening talks on *"OR in the Energy and Transportation Sectors"* by *Dr. Martina Fischetti, Dr. Meltem Peker Sarhan, Dr. Alina Gabriel Dragomir, Dr. Annarita De Maio* and *Dr. Lavinia Amorosi*. For more details please see https://www.euro-online.org/web/pages/1654/wisdom.

WISDOM is delighted to participate in *EURO 2021*: The *EURO 2021* Conference in Athens is organized by *EURO* and the Hellenic Operational Research Society (*HELORS*). *EURO'21* Athens will be held in a hybrid format on July 11-14, 2021.

WISDOM will host a roundtable discussion on *"Networking - career progression strategies"* with *Prof. Renata Mansini* (*WISDOM* Forum), *Prof. Ruth Meisner* (EPSRC Early Career Research Fellow), *Dr. Alberto Santini* (*EUROYoung*), and *Prof. Paolo Toth* (former *EURO* president, and *EURO* Gold Medal winner).

WISDOM will also present award certificates to the finalists of the *YoungWomen4OR- 2020* initiative, during workshops to spotlight their work. For more details see https://euro2021athens.com/women-in-or-event/.

Online Edition of EvoCOP Widens participation significantly

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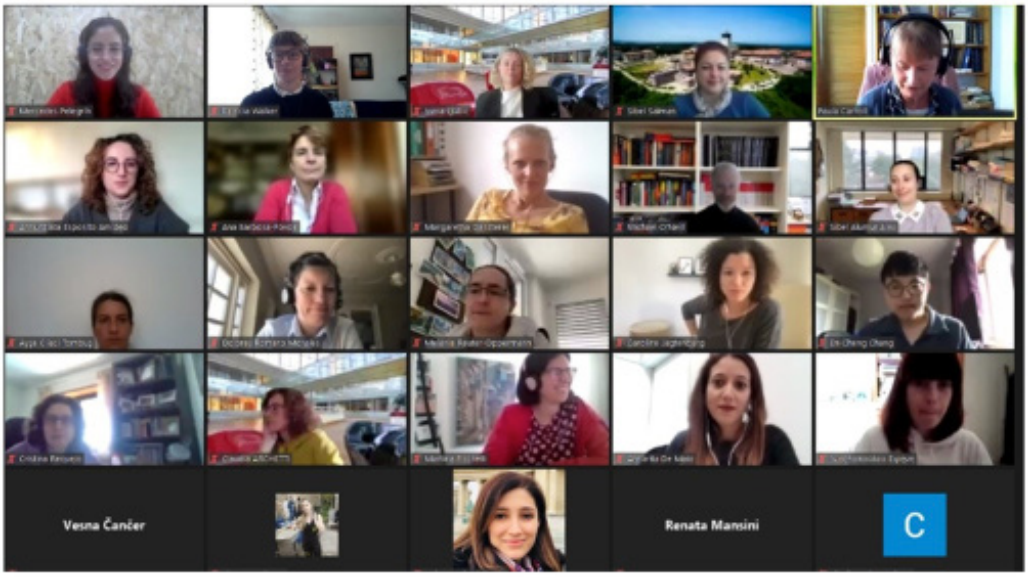
The *European Conference on Evolutionary Computation in Combinatorial Optimisation (EvoCOP)* is a multidisciplinary conference that brings together researchers working on applications and theory of evolutionary computation methods and other metaheuristics, including local search methods and hybridisations with exact methods (matheuristics), for solving difficult combinatorial optimisation problems appearing in various industrial, economic, and scientific domains. It is held annually at different locations throughout Europe as part of *EvoStar* (*Evo**, http://www.evostar.org), which comprises three additional co-located conferences in the wider ar-ea of evolutionary computation: *EuroGP* (Genetic Programming), *EvoMUSART* (Evolutionary and biologically inspired music, sound, art and design) and *EvoApplications* (Applications of Evolu-tionary and bio-inspired Computation). *EvoStar* is organised by *SPECIES*, the Society for the Promotion of Evolutionary Computation in Europe and its Surroundings (http://species-society.org). All proceedings have been published by Springer Nature as part of its Lecture Notes in Computer Science (LNCS) series and are indexed by DBLP (https://dblp.org/db/conf/evoW/index.html).

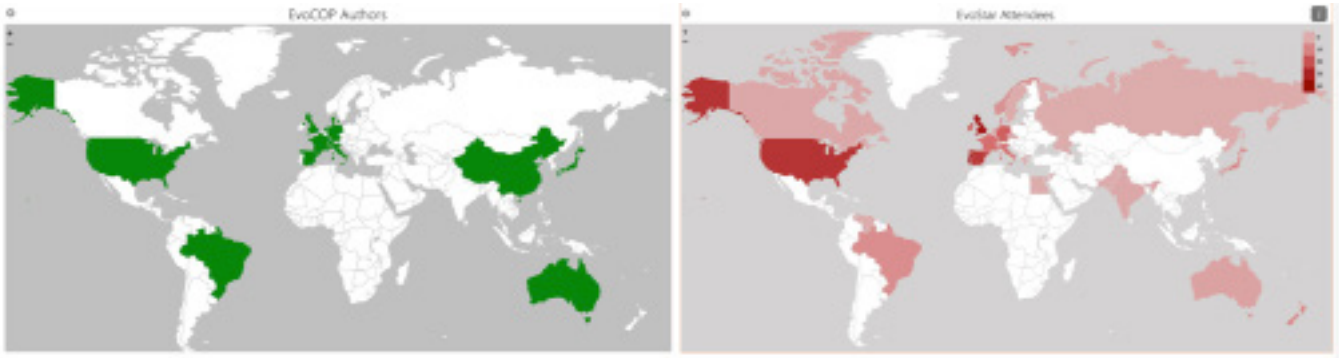


▲ *YoungWomen4OR Webinar:* our participants.

Although *EvoCOP* is usually an on-site event, due to the COVID-19 pandemic, the last two edi-tions have been held as online-only events. The *21st edition of EvoCOP* (http://www.evostar.org/2021/evocop/) was held from April 7-9, 2021, using a combination of dif-ferent tools, namely ZOOM, YouTube and Gather. It was chaired by *Christine Zarges* from Aber-ystwyth University, Wales, United Kingdom, and *Sébastien Verel* from Université du Littoral Côte d'Opale, Calais, France. Recordings of talks will be published on the *SPECIES* YouTube channel (https://www.youtube.com/channel/UCkcCOKhkap8CRLsAVhUwh1Q).

EvoCOP accepts two types of submissions: regular (full) papers and late-breaking abstracts. Only regular papers are published in the LNCS proceedings, with a limit of 16 pages. *EvoCOP 2021* received 42 full paper submissions from all over the world. After a rigorous double-blind reviewing process involving 57 programme committee members, 14 full papers were accepted for publica-tion (see https://doi.org/10.1007/978-3-030-72904-2 for proceedings). These papers provide an excellent reflection of hot topics and the current state of research in the fields of evolutionary computation and combinatorial optimization. The wide range of topics included applications in scheduling, routing, quantum computing, and search-based software engineering, general graph problems as well as foundational and methodological papers on runtime analysis, fitness land-scape analysis and parameter tuning. Authors represent 14 countries from Europe, Asia, North and South America and Australia. The acceptance rate this year was 33%, among the lowest of all times. In the past 10 years the acceptance rate has come down from 52%, being consistently below 40% since 2018.

Particularly noteworthy are this year's four best paper candidates, three of which have been clas-sified as student papers: *Christian Cintrano, Javier Ferrer, Manuel López-Ibáñez* and *Enrique Alba*: *"Hybridization of Racing Methods with Evolutionary Operators for Simulation Optimization of Traffic Lights Programs"*; *Raphaël Cosson, Bilel Derbel, Arnaud Liefooghe, Hernán Aguirre, Qingfu Zhang* and *Kiyoshi Tanaka*: *"Decomposition-based Multi-objective Landscape Features and Automated Algorithm Selection"*; *Amirhossein Rajabi* and *Carsten Witt*: *"Stagnation Detec-tion with Randomized Local Search"*; *Preethi Sankineni* and *Andrew Sutton*: *"Symmetry Breaking for Voting Mechanisms"*. Papers are nominated based on reviewer comments and the evaluation of the conference chairs. All best paper nominees have been invited for fast-track publication in the *Evolutionary Computation* journal (MIT Press, https://direct.mit.edu/evco). As usual, the winner of the best paper award was determined by popular vote of the attendees of the best paper session. After an engaging and inspiring talk by *Christian Cintrano*, explaining how evolutionary algorithms could be used to improve traffic flow and environmental impact of traffic in the city of Málaga (and beyond), the audience decided to give the *EvoCOP Best Paper Award 2021* to *Christian Cintrano, Javier Ferrer, Manuel López-Ibáñez* and *Enrique Alba* from the University of Málaga. The best paper award was presented during the closing session (https://www.youtube.com/watch?v=JU2H_o1HFzk) of the conference.



▲ *Locations of EvoCOP authors* (left) and *heat map* of *EvoStar attendees* (right) by country.

Christian Cintrano (University of Málaga, Spain), *Raphaël Cosson* (University of Lille, France) and *Amirhossein Rajabi* (Technical University of Denmark, Denmark) have additionally been recog-nised as Outstanding Students of *EvoStar 2021*.

The conference was opened by *Marc Schoenauer*, the President of the *SPECIES* society, via the *SPECIES* YouTube channel, who warmly welcomed everybody to this online-only edition of *EvoStar* and presented some statistics and recent activities by the society including *SPECIES* scholarships for PhD students and the *SPECIES – Springer Nature* partnership for topical issues in the *SN Computer Science* journals.

▲ *Conference opening by Marc Schoenauer* (https://www.youtube.com/watch?v=9Zf6P4XJe8Q).

The scientific programme of *EvoStar 2021* was organised in three parallel ZOOM sessions, care-fully ensuring that best paper sessions and related sessions of the same sub-conference were not held in parallel. This year time zones of presenters were additionally taken into account so that speakers were not forced to give their talks in the middle of the night in their time zone. *EvoCOP* contributed four sessions to the conference, including one dedicated best paper session.

Two inspiring international keynote speakers completed the outstanding scientific programme. *Darrell Whitley* from Colorado State University, USA, talked about the future of Combinatorial Evolutionary Computation by taking a new view at recombination operators and how they can be used to complement Iterated Local Search. *Susanna Manrubia* from the *National Centre for Biotechnology (CSIC)*, Spain, introduced us to her transdisciplinary research of evolutionary dynam-ics and genotype-phenotype maps. Both keynotes were held on YouTube to allow attendance from researchers not registered for the main conference.

Last but not least a networking and poster session was organised on Gather. All authors and in particular outstanding students were given the opportunity to additionally present their papers as a poster and each conference attendee was given a code to vote for the best student poster. Gather is a great tool to mimic networking during a conference as everybody can see who is present and is able approach others in virtual spaces. While not replacing in-person interaction it certainly added a lot to the overall conference experience. Gather was open throughout the conference, allowing attendees to also meet up over lunch or during coffee breaks.

▲ *Keynotes: Darrell Whitley* (left) on *"Recombination, Parallelism and the Future of Combinatorial Evolutionary Computation"* (https://www.youtube.com/watch?v=denCyimJcVE); *Susanna Manrubia* (right) on *"How the archi-tecture of hyperastronomically large genotype spaces shapes evolutionary dynamics"* (https://www.youtube.com/watch?v=rxTuQ-3sLsg).

EvoStar 2021 has been the second online-only edition of the conference after the 2020 event had to be moved online on very short notice following the first lockdowns in Europe. Reflecting on the past year, there are certainly many irrefutable benefits of in person real-world events and we are all looking forward to meeting each other in person again. However, the move to an online conference also had positive aspects. Online attendance and reduced registration fees have widened participation and helped researchers who find it difficult to travel to conferences. With more than 200 submissions (up approx. 30%) across the four sub-conferences and over 230 at-tendees (up approx. 35%) this year's *EvoStar* has gained significant traction in the field. Discus-sions about moving to a hybrid post-COVID format are under way and will hopefully combine the best of both worlds in the future.

The conference chairs are very grateful to the *EvoCOP* Steering Committee, the *SPECIES* society and the *EvoStar* organising committee for their valuable support during the organisation and publicity of the conference. Last but not least, a conference would not be successful without the active engagement of participants and speakers who are at the heart of fruitful discussions. Thank you for attending *EvoCOP* and *EvoStar 2021*!

In this spirit: See you at *EvoCOP 2022* – wherever it will be!

hSNS Workshop 2021 - Online: Portuguese Public Hospital Performance Assessment using a Multicriteria Decision Analysis Framework

Diogo Cunha Ferreira <diogo.cunha.ferreira@tecnico.ulisboa.pt>;
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▲ *hSNS Workshop 2021:* presentation.

Promoted within the scope of the *hSNS Project* (https://hsns.eu/), entitled *"Portuguese public hospital performance assessment using a multicriteria decision analysis framework"*, the *hSNS Workshop 2021* (https://workshop.hsns.eu/) focused on studies applying Operational Research (*OR*) techniques, particularly Multiple Criteria Decision Analysis (*MCDA*), to health care delivery, management, and policy. The workshop was held online, and it included two keynote sessions and three regular sessions.

Regarding the keynote sessions, the first keynote, presented by *Greg Zaric*, Professor of Management Science at the Ivey Business School of Western University, Canada, focused on sub-optimal decision-making within health systems, resulting from different information and objectives among different stakeholders. Risk-sharing, gain-sharing, and incentive payments were discussed as measures to coordinate the actions and decisions of multiple parties. The second keynote, presented by *Vedat Verter*, John McConnell Endowed Chair of Business Administration at the Michigan State University's Broad College of Business, United States, addressed efficiency in health care delivery and health care quality. The implementation of health policies through concerted and sustained efforts at the operational level was discussed.

As for the regular sessions, a total of eleven studies have been presented. In order to promote the effectiveness of the regulatory activity in health care, the correct supervision of providers, the avoidance of quality shading issues, and healthy competition in the sector, the ELECTRE Tri-nC MCDA method has been used to develop a five-star "hotel-like" rating system in one of the studies. The proposed rating system has been applied to Portuguese public hospitals to prove its usefulness and validity. The ELECTRE TRI-nC has also been used in another study to assess the quality of Portuguese public hospitals through patient safety, care appropriateness, and access. Another ELECTRE method, the ELECTRE-Score, has been used to evaluate the Healthcare Access and Quality index. Contrary to other methods, the ELECTRE-Score compares each alternative with sets of reference actions, to which a score has been assigned, and assigns a score range to each of the alternatives.

Several of the presented studies employed Data Envelopment Analysis (DEA). One of the studies employed the CCR model oriented to output maximization to assess the efficiency of primary care services in the Brazilian state of Santa Catarina. Moreover, through the Malmquist index, the productivity evolution of these services has been assessed from 2008 to 2014. Network DEA has been used in another study to assess the efficiency of different countries in responding to the COVID-19 pandemic. Through different inputs related to health expenditure and specific health costs associated with the pandemic, desirable and undesirable intermediate products related to the use of masks and infected population, respectively and desirable and undesirable outputs such as COVID-19 recoveries and deaths, countries have been assessed from social and economic perspectives. Network DEA has also been used in a study addressing the link between investment in water and sanitation services and the dissemination of waterborne diseases in Brazil. In addition to network DEA, a study using Value-Based DEA (VBDEA) to assess the impact of COVID-19 in the efficiency of Portuguese hospitals has been presented. >>

Keynote speaker 1: *Greg Zaric*, Ivey Business School, Western University, Canada:
"The keynote speaker talked about incentives and coordination in healthcare".

Keynote speaker 2: *Vedat Verter*, Broad College of Business, Michigan State University, USA:
"The keynote speaker talked about improving access to care (take-aways from two case studies)".

▲ *hSNS Workshop 2021:* keynote speakers.

>> Indicators, including hospital capacity, labor, expenditure, activity, and quality have been considered. In addition to the previous studies, a DEA-based "Benefit-of-the-Doubt" model has also been presented in its directional formulation. The model is used to build a composite indicator, given its ability to deal simultaneously with desirable and undesirable outputs and incorporate preference information from decision-makers. The approach is used to assess the performance of Portuguese public hospitals from the perspective of users and providers.
Another study addressed the satisfaction of health care consumers. Four methodologies found in the literature, including regression analysis, factor analysis, structural equation modeling, and multicriteria satisfaction analysis, have been used and compared to determine predictors for patient satisfaction.

▲ *hSNS Workshop 2021:* presentation cover.

A study on applying multi-objective mathematical programming to the delivery of home social care services has also been presented. The approach employs Chebyshev's method to solve the multi-objective model consisting of the maximization of equity in allocating caregivers to the users and minimizing operating costs.

Finally, the presented studies have been considered for publication in a Special Issue of the Socio-Economic Planning Sciences journal, entitled *"Methods and techniques for assessment of health care performance"* and guest edited by *Diogo Cunha Ferreira*, *Ana Camanho*, and *José Rui Figueira*. Evaluating the performance of health care systems (HCS) is critical to promote the elimination of inefficiencies, enhance service quality, and ensure the adequate supply of health services, which have become even more important within the context of the COVID-19 pandemic. Several approaches have been proposed in the literature to measure the performance of HCS, including DEA models, robust DEA approaches, Stochastic Frontier Analysis (SFA), and total factor productivity indices. This Special Issue focuses on theoretical contributions and innovative application frameworks to assess the efficiency, quality, and access to HCS worldwide, including but not limited to the following topics: measuring the impact of public policies or social programs related to HCS performance; HCS performance in a variety of scenarios, such as in wealthy and developed nations, or impoverished and social excluded regions; theoretical and methodological challenges in understanding the determinants of HCS performance; patterns and trends in HCS performance, across time, contexts, and demographic groups; social determinants of HCS performance as they relate to demographic changes; contextual determinants of HCS performance and health disparities; and cross-national perspectives in the examination of HCS performance. The link of the special issue website is as follows: https://www.journals.elsevier.com/socio-economic-planning-sciences/call-for-papers/methods-techniques-assessment-of-health-care-performance.

Computing, Machine Intelligence and OR successfully Discussed: ICMI 2021 - in Istanbul and Online

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The *1st International Conference on Computing and Machine Intelligence (ICMI 2021)* was held *virtually* on February 19-20, 2021, in Istanbul, Turkey (https://icmi.aiplustech.org). The event was organized by the Department of Computer Engineering Istanbul Sabahattin Zaim University, and Artificial Intelligence + Tech. General chairs of *ICMI 2021* were *Dr. Ismail Kuçük* from Istanbul Sabahattin Zaim University, *Dr. Hasan Kömürcügil* from Eastern Mediterranean University, and *Dr. Akhtar Jamil* from Istanbul Sabahattin Zaim University.

The main topics of the *ICMI 2021* conference were Artificial Intelligence and Machine Learning, Computer Vision and Image Processing, Big Data, and IoT, where a high contribution of these fields came by their interactions with *Operational Research* (*OR*). All papers were peer-reviewed by two reviewers and evaluated based on originality, technical and/or research content/depth, correctness, relevance to conference, contributions, and readability. The acceptance rate of the submissions was 78%.

▲ Poster of the *ICMI 2021*.

The conference started with Istanbul Sabahattin Zaim University's introductory video followed by opening speeches. Three valuable keynote speeches were in the conference program. *Associate Prof. Dr. Alfredo Vellido* from Universitat Politecnica de Catalunya, Barcelona, Spain, presented *"Time to tame the beast: societal impact of machine intelligence"*, *Prof. Dr. Samee U. Khan* from Mississippi State University, USA, talked about *"Machine Learning and Computer Systems – An Absolute Necessity"*, and *Prof. Dr. Ge Wang* from Biomedical Imaging Center, Rensselaer Polytechnic Institute, Troy, USA, spoke about *"Deep Learning for Tomographic Image Reconstruction"*.

ICMI 2021 was an important conference on the development of Computing and Machine Intelligence and its applications in various fields, and provided the global research community with the opportunity to discuss the latest research results in the main areas of artificial intelligence, machine learning, and software computing and related fields. Researchers presented 77 papers in 16 sessions over two days. Authors of papers were from 20 different countries (Turkey, Pakistan, Andorra, Bangladesh, United States, Spain, Italy, Ireland, Jordan, India, France, Morocco, China, United Kingdom, Iraq, Indonesia, Canada, Russia, Saudi Arabia, and Albania). During the conference, a friendly and comfortable environment was provided, thus participants from different countries of the world had the opportunity to "come together", and new international collaborations were discussed.

▲ Keynote speakers at *ICMI 2021:* (L-R) *Prof. Dr. Alfredo Vellid, Prof. Dr. Samee U. Khan* and *Prof. Dr. Ge Wang*.

Discussion topics included: decision support systems; AI and evolutionary algorithms; constraint-based reasoning and constraint programming; object detection, recognition and categorization; statistical learning and pattern recognition; parallel and distributed computing; big-data models and algorithms. The most frequently asked question throughout the presentations was how the hyper-parameters of machine learning algorithms are tuned. Some of the authors answered that they used optimization techniques to tune hyper-parameters; while others answered that they tuned hyper-parameters through trial and error.

The session where studies on the diagnosis of COVID-19 with artificial intelligence were presented, was the most popular session among participants. *Fatih Mert* from Istanbul Commerce University, *Muhammed Ali Aydin* from Istanbul University, Cerrahpasa, and *Abdul Halim Zaim* from Istanbul Commerce University showed useful applications of machine learning in solving also social problems with their work *"Developing a Protective – Preventive and Machine Learning Based Model on Child Abuse"*.

In the closing session of the conference, *Dr. Akhtar Jamil* and *Dr. Alaa Ali Hameed* made a general assessment of the conference and announced the best-paper awardees. According to the decision of the session chairs, reviewers, and the conference committee, *Zeliha Ergul Aydın* and *Zehra Kamisli Ozturk* with *"Performance Analysis of XGBoost Classifier with Missing Data"* received the award. This paper was about health data and their *missing values*.

Participants gave positive feedback and comments about the keynote speeches, preparations, and paper presentations. Participants from academia and industry enjoyed listening to the presentations, testified that people from numerous universities, sectors and all over the world learned a lot about "big data" and other *OR*-related topics, while meeting online under our present common conditions of pandemics. The event was generally considered a very successful event!

The *ICMI 2021* Proceedings book is available online on conference website under https://icmi.aiplustech.org/assets/docs/Proceedings.pdf.

Virtual | 2021 INFORMS Business Analytics Conference

Dayana Cope <dayanac@gmail.com>

This article is a modified version of an article by the Virtual 2021 INFORMS Business Analytics Conference chair Dayana Cope, printed in the February 2021 issue of the INFORMS member magazine OR/MS Today and is reprinted with permission from INFORMS.

To ensure the safety of conference attendees and presenters during the ongoing COVID-19 pandemic, *INFORMS* invited attendees to participate in a fully virtual 2021 Business Analytics Conference that prioritized both top content and enhanced interactivity between attendees. This marked the second year the Business Analytics Conference transitioned from an in-person to a virtual event. As such, conference organizers were better positioned to offer a great conference experience for attendees. This conference, held April 12-14, 2021, featured high-quality sessions and speakers across cutting-edge tracks, showcasing the myriad ways analytics is saving lives, saving money and solving problems across the globe.

Showcasing Relevant Topics

The *INFORMS* staff, *Invited Track Committee* and *Selected Track Committee* (consisting of analytics experts from industry, academia and consortia) worked diligently to craft a top-of-the-line conference schedule. Thoughtful and careful selection of speakers for more than 10 tracks provided attendees with practical experience, best practices and application of new approaches in the field of business analytics. Topic tracks included: Analytics Leadership, Analytics in the Public Sector, Emerging Analytics, Marketing Analytics, Revenue Management and Pricing, and Supply Chain. Additionally, there were tracks featuring the finalists in the 2021 Franz Edelman Competition and recipients of other Institute-wide prizes, such as the Wagner Prize, INFORMS Prize and UPS George D. Smith Prize. To assist attendees in the selection of topics that are relevant and match their individual interests and experience level, this year the conference classified all talks – based on the content of presentations – as associate, professional or executive.

▲ *INFORMS 2021 Business Analytics Conference:* Opening Plenary by *Kate Darling*.

▲ Logo of the *INFORMS 2021 Business Analytics Conference*.

Due to the COVID-19 pandemic and the impact it has had on the life sciences, a track was dedicated to the application of actionable analytics in that field. This track highlighted the ways that analytics has been applied to solve the most challenging and relevant problems related to the current pandemic, as well as technological innovation, healthcare access and delivery, regulatory and public health. During this track, life sciences industry leaders highlighted analytic innovations that prescribe the future narrative that the ecosystem requires in order to adapt to continued change.

Another new track this year focused on the application of analytics in parks, recreation and tourism. This track highlighted innovative applications of analytics in the identification, understanding and implementation of environmentally friendly projects in the hospitality, recreation and tourism industry. Conference organizers hoped to bring together industry leaders to share best practices on how to leverage advanced analytics techniques for the planning, management and marketing of ecotourism and environmentally sustainable options.

Kate Darling, a leading expert in social robotics and a research specialist at the MIT Media Lab, gave the opening plenary address (sponsored by the *INFORMS Roundtable*) on *"The Future of Human-Robot Interaction"*. She explored the emotional connection between people and life-like machines, in order to influence technology design and policy direction by anticipating difficult questions which lawmakers, engineers and the wider public will need to address as human-robot relationships evolve in the coming decades.

▲ *INFORMS 2021 Business Analytics Conference:* Plenary Speaker *Chris Wiggins.*

The second plenary speaker was *Chris Wiggins*, associate professor of applied mathematics at Columbia University and the chief data scientist at *The New York Times*. Wiggins is also a co-founder and co-organizer of *hackNY*, a nonprofit that since 2010 has organized student hackathons and the hackNY Fellows Program, a structured summer internship at NYC startups. Wiggins provided a glimpse into the data science group at *The New York Times* and discussed how they develop and deploy machine learning solutions to newsroom and business problems.

Enhancing Interactivity

An important consideration when the decision was made to move the 2021 Business Analytics Conference to a virtual format was the ability to provide interactive social opportunities for attendees. Although it is difficult to replicate an in-person conference, the meeting planning committee worked to provide opportunities for informal connections and the feeling of being part of a community. One of the changes this year was a more "virtual-friendly" format that incorporated frequent and engaging networking opportunities and facilitated networking for attendees, even among different time zones.

This year's conference also leveraged a new platform that supported social interactions and networking throughout the conference. Using AI-based technology, attendees were connected to their own personal network of like-minded individuals with similar interests, experience and career goals. To that end, the platform hosted plenty of opportunities to interact through a combination of live chats and discussion boards. Individual tracks promoted hashtags to encourage conversation in the conference platform and on social media.

In addition, the session format was modified to capture and engage a virtual audience, and live Q&A sessions after each presentation and panel session encouraged interactive participation. Content is available for 30 days after the conference to give attendees the opportunity to revisit any content they might have missed while the conference was live.

Attendees were also invited to virtually recognize and celebrate the contributions of the finalist teams and celebrate the announcement of the winners of the competitions for top *INFORMS awards* including the *Daniel H. Wagner Prize*, *UPS George D. Smith Prize*, *INFORMS Prize* and *Franz Edelman Award*.

The *Daniel H. Wagner Prize* for *Excellence in the Practice of Advanced Analytics and Operations Research* was awarded to researchers from The Pennsylvania State University, The University of Texas at Austin and University of British Columbia for their work to increase efficiency in product planning and supply in agribusiness, providing unique applications of analytics and *OR* to improve the distribution and performance of crops to achieve monetary and nonmonetary benefits. The competition took place at the INFORMS Annual Meeting last fall and the award was presented at the conference.

The *UPS George D. Smith Prize*, named in honor of the late UPS Chief Executive Officer, was awarded to the Department of Business Analytics at the University of Iowa. The program has been evolving for decades but hit its peak in 2019 with the official naming as the department of business analytics. Despite management science courses being offered for some time, the program has continued to develop by adding courses in operational research and now business analytics. Program highlights include a capstone project with companies in industry and prepares students to be effective practitioners of operations research with the help of the Tippie Analytics Cooperative Advisory Council and specific professional preparation courses.

▲ *INFORMS 2021 Business Analytics Conference:* Edelman Award Ceremony.

Amazon was presented with the *INFORMS Prize* for sustained and enduring institutional achievement across all elements of its business, notably Amazon Transportation Services. The *INFORMS Prize* honors effective integration of *OR* and analytics into organizational decision-making and is awarded to organizations that have repeatedly applied the principles of *OR* in lasting ways.

The recipient of the *Franz Edelman Award* for Achievement in Advanced Analytics, Operations Research and Management Science was the *United Nations World Food Programme* (*WFP*) for its use of operational research to master food assistance amid emergency responses. *WFP* is the *2020 Nobel Peace Prize Laureate*, assisting nearly 100 million people across 88 countries. As the world's largest humanitarian organization, the responsible use of innovation and technology transforms the way *WFP* saves and changes lives in emergencies and long-term development programs that build strong and resilient communities. It enables *WFP* to help and empower more people, more quickly and more cost-effectively than ever before.

The 2020 conference brought together analytics professionals from across the globe for carefully cultivated opportunities to learn and connect and take valuable new insight and best practices back to their organizations, while expanding their professional networks. Serving as the chair of this unique virtual event has been an exciting and eye-opening experience that I won't soon forget!

▲ *INFORMS 2021 Business Analytics Conference,* Edelman Award Ceremony: the *U.N. World Food Programme;* on the photo: *Mr. Sergio Silva.*

Dayana Cope is director of simulation and data analytics at *Engineering USA*. She served as the general chair of the *Virtual 2021 Business Analytics Conference*.

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International Early-Career Researchers Workshop on Integrated Planning in Hospitals: Complexity, Analytics, Reorganization, Efficiency (InPlan-CARE)

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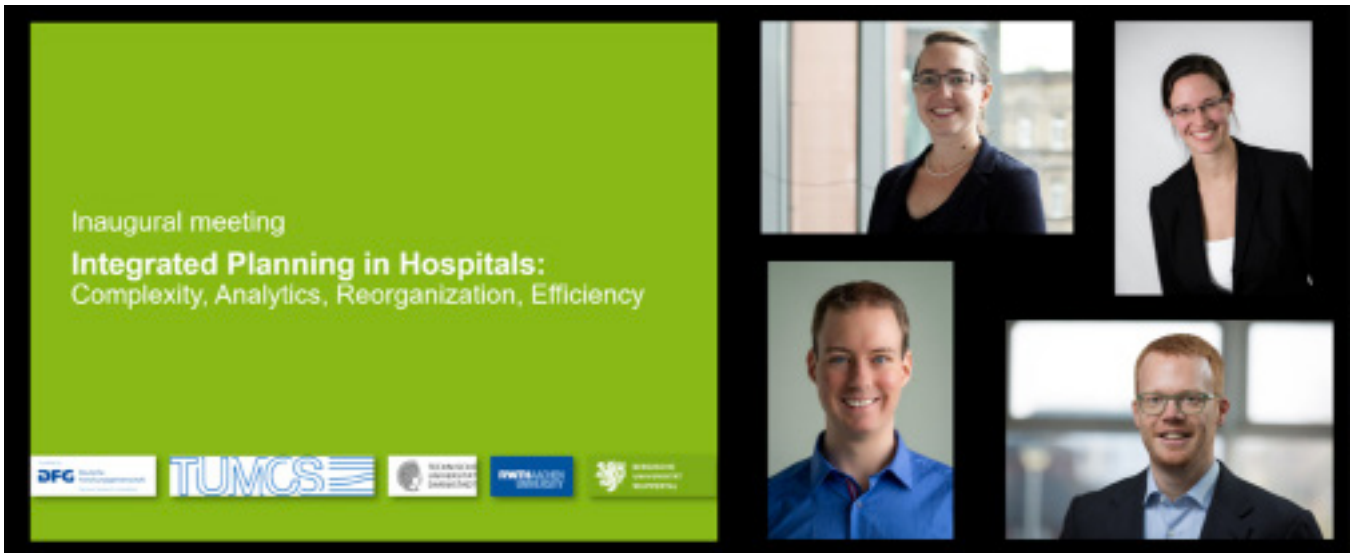
Clemens Thielen <clemens.thielen@tum.de>



▲ InPlan-Care welcoming slide and organizers Melanie Reuter-Oppermann, Christina Büsing, Clemens Thielen and Sebastian Rachuba.

The *InPlan-Care network*, organized by German *OR* researchers *Christina Büsing* (RWTH Aachen, Germany), *Sebastian Rachuba* (University of Wuppertal, Germany), *Melanie Reuter-Oppermann* (Technical University of Darmstadt, Germany) and *Clemens Thielen* (Technical University of Munich, Germany), aims at developing *OR* approaches for integrated planning in hospitals. Last September, a virtual warm-up meeting was held to give the network members the opportunity to get to know each other. The project then officially started with an online workshop on March 15, 2021. Equipped with tools such as ZOOM and Miro boards, challenging research topics to focus on were identified. *Sean Manzi* (University of Exeter, UK) shared his experiences and research ideas regarding the integrated planning of emergency departments and hospital beds. *Christina Bartenschlager* (University of Augsburg, Germany) gave insights into her current work around surgery scheduling. It was a fun and successful workshop. All members are looking forward to join forces and improve service delivery in health care with their research projects in the coming months and years. We believe that such networking events for early-career researchers are extremely important. While we hope for on-site meetings to be possible again, soon, we realized that online tools like ZOOM make it easier to connect and exchange ideas with researchers worldwide on a regular basis. We therefore aim to establish these workshops as a networking platform in addition to the "classical conferences".

A well-performing health-care system is one of the most important factors for the prosperity and well-being of a society. In this context, hospitals serve as one of the key providers of health care services. Efficient service provision and, thereby, high-quality health care requires the necessary resources such as personnel and beds to be dimensioned correctly and to be available in the right place at the right time. Typically, resource-related planning problems are treated separately for each resource without integrated planning across several resources. This leads to globally sub-optimal decisions and unused potential for high-quality health care services. Moreover, these problems are often dealt with by clinical staff who are not trained for this kind of complex decisions. This reduces their available time for patient treatment and care.

In order to develop a holistic view on integrated planning problems in health care, an international young researchers' network was established, supported by a 3-year funding granted by the *German Research Foundation* (DFG, Deutsche Forschungsgemeinschaft). This network brings together 17 early-career operations researchers from seven countries worldwide (Germany, Austria, Belgium, the Netherlands, Norway, the United Kingdom, and New Zealand). All of them have significant expertise in the area of health care management and quantitative planning. The project particularly aims at identifying state-of-the-art research and analyzing the complexity of existing problems in hospitals. In addition, advanced quantitative methods to support decision making for integrated planning in hospitals will be developed. In collaboration with hospitals, these models will be thoroughly evaluated in order to assess their suitability for real-life application and implementation. Finally, this network aims to generate awareness for the necessity of integrated planning among hospital practitioners and within the wider research community – especially strengthening interdisciplinary research. Specific research questions addressing the objectives of this project will be discussed during workshops. Talks at national and international conferences and publications in peer-reviewed journals will ensure suitable dissemination of the obtained results.

The *InPlan-Care network* plans another digital workshop in the second half of 2021 and hopefully on-site meetings at different locations in the next two years. Further information can be found here: https://cnw.cs.tum.de/inplan-care/.

Community Service Activities through International Webinars: OR, Data Science, and the Impact on COVID 19 – Jakarta, Indonesia & online collaboration with Turkey

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The novel coronavirus disease (COVID-19) was first identified in Wuhan, China, in early December 2019, but has since spread to other parts of the world. The disease at the time of this report has been declared a pandemic by the World Health Organization (WHO). As of February 28, 2021, the *Indonesian Government* announced 1,334,634 confirmed COVID-19 cases in 34 provinces in Indonesia, with 155,765 active cases, 36,166 deaths, and 1,142,703 people having recovered from the disease. The government also reported 71,668 suspected cases.

In a situation like this it is necessary to consider an outbreak management strategy, so that it can provide consideration for decision making in terms of future progress that can measure risk and for direct mitigation strategies. The spread of the infected over time can be traced, so that the pattern can be studied. The forecasting method will be considered based on the pattern and time period. To solve this problem, Data Science is very helpful because it creates useful technological solutions. These technology-capable digital tools address problems that, if approached in a conventional manner, would require more time and effort to solve. A main insight that has to join at this point consists in the important offers of Operational Research (*OR*).

▲*International Webinar flyer: "Data Science and Impact on COVID 19"*, organized by Mercu Buana University, Jakarta, Indonesia.

"Information Systems" of Faculty of Computer Science at *Mercu Buana University*, Jakarta, Indonesia, in collaboration with the Faculty of Economics, Administrative and Social Sciences, at *Istanbul Gelisim University*, Istanbul, Turkey, held a one-day virtual seminar-conference about *community service activities* on the topic: *"Data Science and the Impact of COVID 19"*, using the ZOOM platform on February 24, 2021, with 2 Keynote Speakers:

The first Keynote Speaker, *Prof. Dr. Anton Abdulbasah Kamil* from Istanbul Gelisim University, Istanbul, Turkey, worked out the topic: *"Data Science and the impact of COVID 19"*, and the second speaker, *Dr. Yaya Sudarya Triana*, from Mercu Buana University, Jakarta, Indonesia, elaborated the topic of *"Implementation of data science"*.

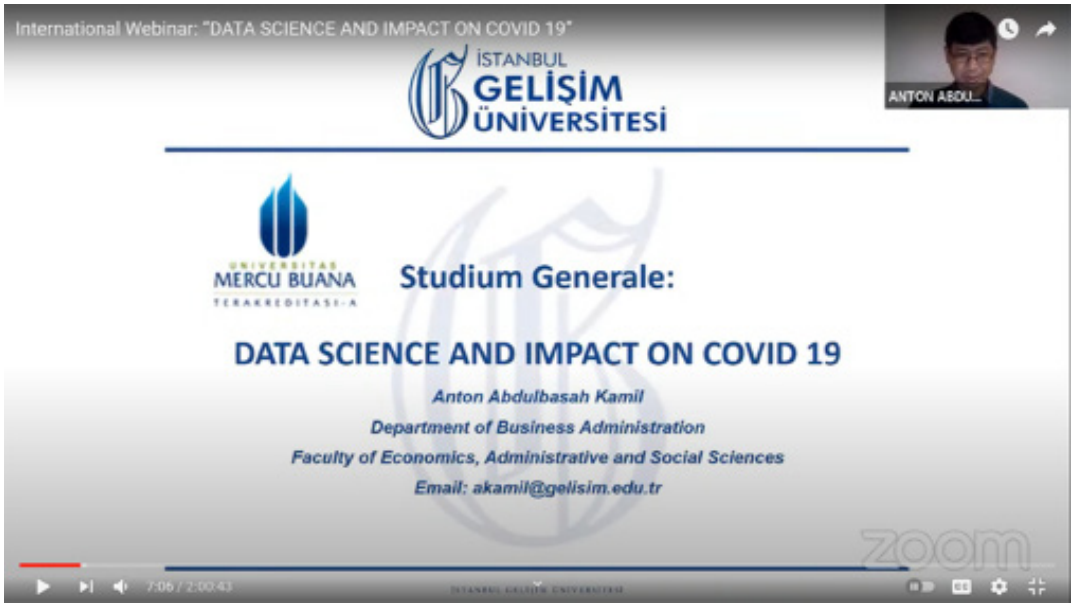
As the first speaker, *Prof. Anton Abdulbasah Kamil*, pointed out, *OR* and Data Science were mostly discussed as disciplines "orthogonal" to each other, although there are some overlaps. In particular, *Time-series Estimates* appear in non-trivial quantities in *OR*. This is one of the more important parts of *OR*, involving highly mathematical and also less mathematical programming. *OR* is the place to turn if it is known that there is a relationship between input and output; *Data Science* is a place to turn when trying to define these relationships (for some definitions of input and output). In practical terms, how the two groups usually come together: the *OR* side develops the decision-making model, and the Data Science side determines the implementation of the appropriate data to feed the model. Modern *OR* and Analytics serve in both groups.

The COVID-19 pandemic problem can be regarded as an optimization problem. *Linear Programming* is a great tool for determining optimal solutions in minimization and maximization problems given a set of constraints. By applying *Monte-Carlo Simulations* to such programs, we can see how optimal solutions change with random shocks.

Understanding how the population moves is important to prevent the spread of the virus and to see how effective quarantine measures are. Tracking the movement of the population without compromising data privacy is a necessity. One of the examples is the *Mobility Monitoring* in Turkey ("HES" - Life Fits into Home) which uses data collected from anonymized users who have opted-in to provide access to their location data anonymously. Data are collected from smartphones with iOS and Android using multiple sensors such as GPS, Wi-Fi and networks. The goal is to quantitatively analyze the impact of the confinement and social distancing measures imposed in Turkey.

What needs to be prepared in Data Science and *Analytics?*

1. *Open Research Dataset* to develop *text and data mining tools* that can help the medical community to develop answers to high priority questions.
2. *Forecasting which involves estimates of confirmed cases and deaths per region*. However, the main aim is not only to produce accurate estimates but also to *identify factors* that appear to influence the transmission rate of COVID-19.



▲ *International Webinar "Data Science and Impact on COVID 19"*: 1st Keynote Speaker *Prof. Dr. Anton Abdulbasah Kamil* (Istanbul Gelisim University, Turkey).

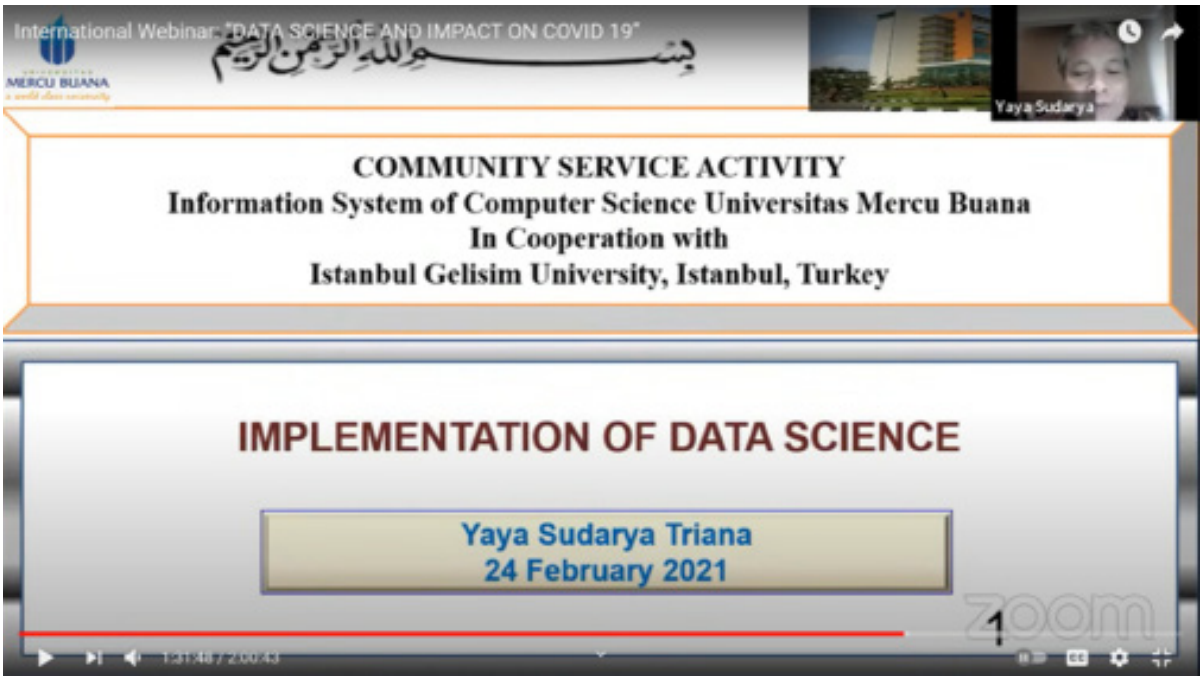
3. *Exposing COVID-19, to generate answers* to key questions developed and evaluated by global front-line healthcare providers, hospitals, suppliers, and policy makers.

There are many models currently in use for the spread of COVID-19, most of them using the *SIR* (Susceptible, *I*nfected, and *R*ecovered) *model*, which is presented as a graph in separate time steps, starting with the number of infected nodes and then showing how the disease spreads in the population over time. To use this model, it is necessary to include a graph that precisely models the current population, the disease transition rate and the mortality rate for the disease. However, there is currently no consensus on what these parameters are for COVID-19, which makes it difficult to model. We can use machine learning to estimate the value of this parameter, and use the SIR model to measure the spread of disease.

In early 2021, many vaccines have already been in the testing phase but several others are still being developed. Machine learning is used to analyze viral sequences to identify parts (epitopes) that the vaccine can target. One of these initiatives comes from the NEC, where the team analyzed thousands of virus sequences and identified epitopes for the 100 most frequent HLA alleles in the global population, scanning all the proteins in the SARS-CoV-2 virus. They looked for regions in the viral proteome that are less likely to mutate in future strains and are also less likely to develop side effects in humans, publishing them on *biorXiv*. The results of this analysis can be used by researchers to develop vaccines that are more effective and less harmful to the population.

For a country like Indonesia which consists of many islands, the most important thing is to prevent from a wider spread. Therefore it is necessary to seriously analyze population mobility during quarantine as well as modeling and projections of distribution in the face of the impact of natural disasters COVID-19 pandemic. Data Science and *OR-Analytics* are certainly very helpful for the government to make a policy.

The second speaker, *Dr. Yaya Sudarya Triana*, discussed the implementation steps for successful data and systems. Several steps need to be considered. *First step:* Identification of Stakeholders and Motivation for Improving Facility Data. *Second step:* Document Facility Registry Specifications and User Stories. *Third step:* Prepare Initial Examples. *Fourth step:* Gap Identification & Iterative Development through User Testing. *Fifth step:* Scale Registry Implementation. *Sixth step:* Provide Continued Support.



▲ *International Webinar "Data Science and Impact on COVID 19"*: 2nd Keynote Speaker *Dr. Yaya Sudarya Triana* (Mercu Buana University).

Reminiscence on the KOI 2020 Conference in ancient Šibenik, Croatia

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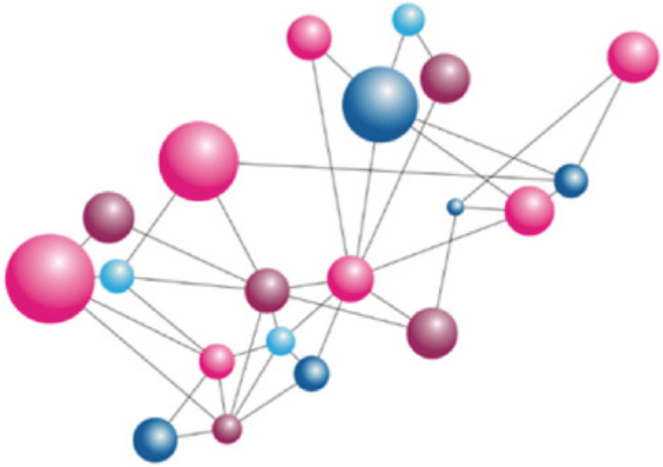
Gerhard-Wilhelm Weber <gerhard-wilhelm.weber@put.poznan.pl>

The operational research, statistics and data analytics community in the *Central Europe* region experienced a difficult year 2020. Many events had to be cancelled, postponed or switched to the virtual regime. An important exception, which was managed to be organized in a mixed on-site and on-line regime, was the *18th International Conference on Operations Research - KOI 2020*, the main meeting of the *Croatian Operational Research Society (CRORS)*. The conference was organized by *CRORS* and *Faculty of Economics and Business, University of Zagreb*. The conference was held in the beautiful city of Šibenik, Croatia, on September 23-25. *Šibenik* is a historic city in central *Dalmatia*, where *Krka* River flows into the beautiful Adriatic Sea. For details about the conference please visit https://hdoi.hr/general-info/koi-2020/.



▲ Logo of *KOI 2020*.

CRORS

▲ Logo of *CRORS*, Croatian Operational Research Society, host of *KOI 2020*.

A special session, chaired by *Prof. Luka Neralić*, was devoted to 80th birthday of *Sanjo Zlobec*, professor emeritus at Department of Mathematics and Statistics, McGill University, Montréal, Canada. A detailed report on this session can be found on web (http://www.amcaqc.org/Pub/Pub_Main_Display.asp?LC_Docs_ID=6254). *Prof. Zlobec* graduated from University of Zagreb in 1965 and later studied at Department of Engineering Sciences at Northwestern University, Evanston, Illinois, USA, with *Prof. Adi Ben Israel*. He has been with McGill since 1970. *Prof. Zlobec* is best known to the wider *OR* community for his book *"Stable Parametric Programming"* (Kluwer, 2001). The area of his expertise in optimization is much wider, including generalized inverses of matrices and linear operators, optimality conditions in parametric programming and problems of stability of mathematical models.

▲ *KOI 2020: Sanjo Zlobec*, Professor Emeritus at McGill, Canada. (Reproduced from: *L. Neralić: Professor Emeritus Sanjo Zlobec: Special session in honour of his 80th birthday*, Almae Matris Croaticae Alumni Québec, http://www.amcaqc.org/Pub/Pub_Main_Display.asp?LC_Docs_ID=6254.)

The special session consisted of nine presentations, including *"Every iteration, away from its fixed points, is Newton"* by *Prof. Adi Ben Israel* (Rutgers Business School, USA), *"C(o)P matrices and optimization"* by *Prof. Abraham Berman* (Technion - Israel Institute of Technology), *"A full-Newton step interior-point method for monotone weighted linear complementarity problems"* by *Prof. Goran Lesaja* (Georgia Southern University, USA), *"Majorization theorems for strongly convex functions"* by *Prof. Muhammad A. Khan* (University of Peshawar, Pakistan) and *"Amiable fixed sets in CW spaces - Brower fixed point theorem extension and day amenable finite group"* by *Prof. James F. Peters* (University of Manitoba, Canada), to name a few.

Recall also that *Prof. Zlobec* belongs to the founders of *CRORS* and holds the *CRORS Distinguished Service Award* for his outstanding contribution to both the society and the operational research profession.

The regular program of *18th International Conference on Operations Research - KOI 2020* was organized in two parallel streams. The conference is an event for a general *OR* community and covers many important areas in the core of *OR* and in related fields, both theoretical and applied, including mathematics and algorithmics of optimization; statistics and econometrics; multicriteria decision making; quantitative finance; data analytics, machine learning and data mining; behavioral *OR* and optimization in human environment. For example, particular presentations were devoted to Data Envelopment Analysis, decision making in the uncertain environment, optimization of productivity and transportation and game theory.

▲ Conference venue (Amadria Hotel Park) and downtown city of Šibenik; reproduced from the conference webpage (https://hdoi.hr/general-info/koi-2020/) and *Encyclopedia Britannica* (brittanica.com).

Due to the pandemic restrictions, only a limited number of participants were able to arrive in person, which contributed to the friendly atmosphere of the conference. Most of the delegates were from Croatia, Slovenia and the Czech Republic. The members of the Czech Republic group, from Faculty of Mathematics and Physics, Charles University, Prague, and Faculty of Informatics and Statistics, Prague University of Economics and Business, would like to acknowledge the excellent work of the organization team, chaired by *Prof. Josip Arnerić* (Faculty of Economics and Business, University of Zagreb, Croatia), in an unstable time. Just a couple of days before the beginning of the conference, the Czech delegation still could not fully confirm that they can indeed arrive due to daily changes in border-crossing regulations and flight cancellations. Finally, everything turned out to be successful and the off-line presence at the conference clearly demonstrated how personal meetings are important and stimulating for the research community.

Readers can look forward to full papers from the conference to be published in a Special Issue of *Central European Journal of Operations Research* as well as *Croatian Operational Research Review*.

▲ *KOI 2020:* Lecture on games with interval-valued characteristic functions (*"Recent Advances in Cooperative Interval Games"*) by *Jan Bok* from Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic. (Photo: *Prof. Milan Hladík*.)

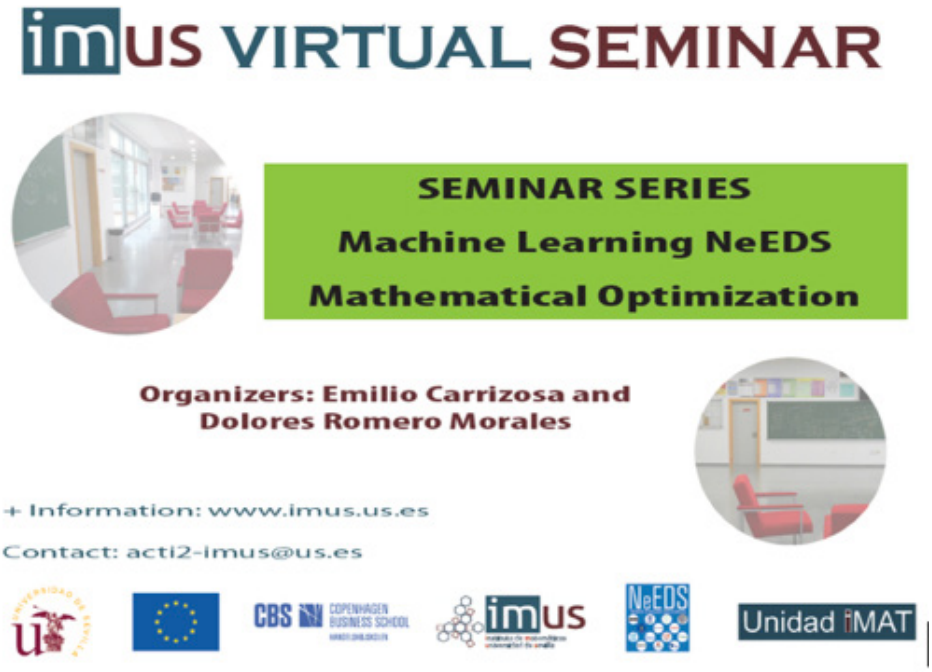
Machine Learning NeEDS Mathematical Optimization and NeEDS has news for you

Emilio Carrizosa <ecarrizosa@us.es>; **Dolores Romero Morales** <drm.eco@cbs.dk>;
Kseniia Kurishchenko <kk.eco@cbs.dk>; **Cristina Molero-Río** <mmolero@us.es>

The Online Seminar Series *"Machine Learning NeEDS Mathematical Optimization"* is 100% virtual and takes place every Monday. It has run from January 11, 2021, through March 22, 2021. The second part takes place from April 12, 2021, through June 7, 2021. The seminar series is supported by IMUS-Instituto de Matemáticas de la Universidad de Sevilla and the H2020 MSCA Research and Innovation Staff Exchange project *"Network of European Data Scientists"* (*NeEDS*) funded by the European Commission.

Leading academics from around the globe (Belgium, Chile, Denmark, France, Germany, Italy, The Netherlands, Spain, Taiwan, United Kingdom, and USA) have been invited to talk about their current work in the area of Data Science and Analytics. The presentations have covered important topics such as enhancing the explainability of black box machine learning models, incorporating fairness to reduce the risk of discrimination in algorithmic decision making, dealing with multiple objectives to build cost-sensitive machine learning models, or fraud analytics. The speakers come from different areas, such as Business, Computer and Information Science, Engineering, Mathematics, Statistics, but Mathematical Modeling and Mathematical Optimization is at the core of all presentations.

This is an initiative from *Prof. Emilio Carrizosa*, IMUS-Instituto de Matemáticas de la Universidad de Sevilla, and *Prof. Dolores Romero Morales*, Department of Economics of Copenhagen Business School, and counts with the great support of *Cristina Molero-Río*, PhD student at IMUS-Instituto de Matemáticas de la Universidad de Sevilla, and *Kseniia Kurishchenko*, PhD student at Department of Economics of Copenhagen Business School. *Cristina* and *Kseniia* organize and lead a satellite event, the *YOUNG* Online Seminar Series *"Machine Learning NeEDS Mathematical Optimization"*. Each *YOUNG* Online Seminar combines the short presentation of three PhD students/ Postdoctoral researchers on their latest results in this burgeoning area.



▲ Poster of the Online Seminar Series "Machine Learning NeEDS Mathematical Optimization"

January 11, 2021: *Prof. I. Birbil* (Erasmus University Rotterdam, the Netherlands) on *"Rule Generation for Learning and Interpretation"*;

January 18, 2021: *Prof. B. Baesens* (Katholieke Universiteit Leuven, Belgium) on *"Challenges in Fraud Analytics"*;

January 25, 2021: *Dr. S. Chatzivasileiadis* (The Technical University of Denmark) on *"Using Optimization to remove barriers for Machine Learning Applications in Power Systems"*;

February 1, 2021: *YOUNG* with *C. Molero del Río* (Universidad de Sevilla, Spain) on *"Mathematical optimization in classification and regression tree"*, *Dr. A. Jiménez Cordero* (Universidad de Málaga, Spain) on *"Feature selection in nonlinear SVM using a novel min-max approach"*, and *C. Lawless* (Cornell University, USA) on *"Fair and Interpretable Decision Rules for Binary Classification"*;

February 8, 2021: *Prof. C. Rudin* (Duke University, USA) on *"Optimization of Optimal Sparse Decision Trees"*;

February 15, 2021: *Dr. V. Blanco* (Universidad de Granada, Spain) on *"Location Analysis meets Data Science"*;

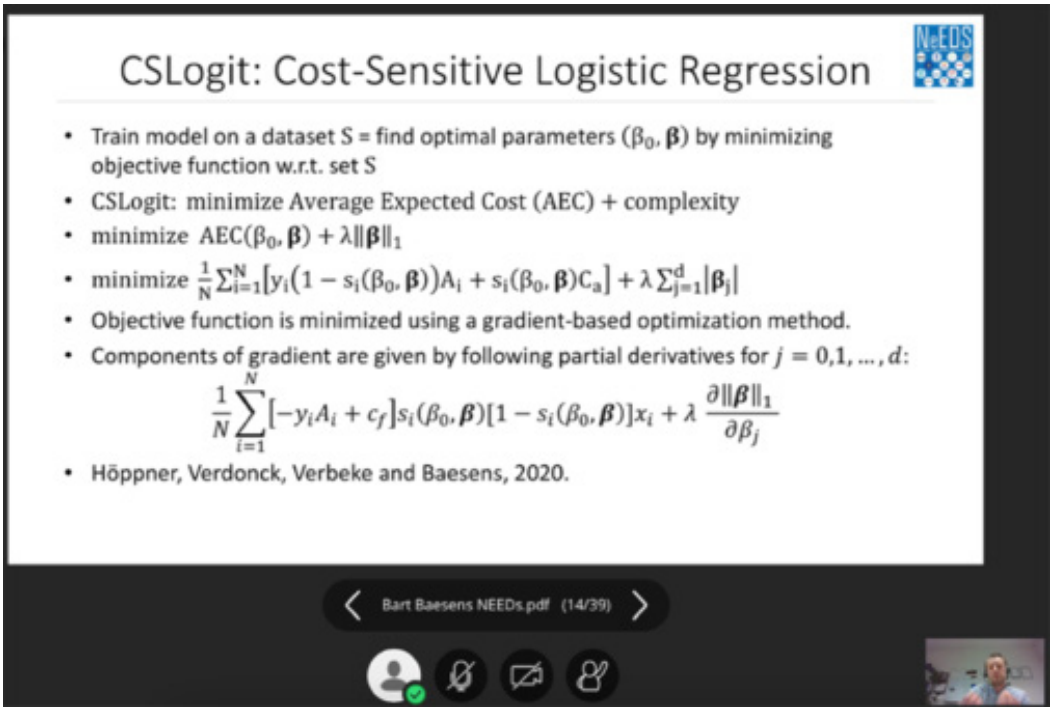
February 22, 2021: *YOUNG* with *K. Kurischenko* (Copenhagen Business School, Denmark) on *"Clustering and Interpreting via Mathematical Optimization"*, *Dr. B. Manca* (Università di Cagliari, Italy) on *"Binary Classification via Ellipsoidal Separation"*, and *M. Morucci* (Duke University, USA) on *"Adaptive Hyper-box Matching for Interpretable Individualized Treatment Effect Estimation"*;

March 1, 2021: *Prof. G. Shmueli* (National Tsing Hua University, Taiwan) on *"Improving" Prediction of Human Behavior Using Behavior Modification"*;

March 8, 2021: *Prof. S. Maldonado* (Universidad de Chile) on *"Cost-sensitive causal classification: novel methodologies and application in business analytics"*;

March 15, 2021: *Prof. I. Valera* (Saarland University and Max Planck Institute for Software System, Germany) on *"Ethical ML: mind the assumptions"*;

March 22, 2021: *Dr. J.M. Morales* and *Dr. S. Pineda* (Universidad de Málaga, Spain) on *"Contextual decision-making under uncertainty"*.



▲ *Prof. B. Baesens*, Katholieke Universiteit Leuven, Belgium, talking at Online Seminar Series *NeEDS* on *"Challenges in Fraud Analytics"*.

More than 750 colleagues, from academia as well as industry, from more than 70 countries are registered in the mailing list of the Online Seminar Series. They receive weekly updates with the link to the seminars and to the uploaded videos in the IMUS YouTube Channel and the NeEDS YouTube Channel. Colleagues attending the seminars have had the chance to interact with the speaker prior to the seminar and during the Q&A session. The organizers have received very positive impact from the speakers, the audience, as well as those watching the videos afterwards.

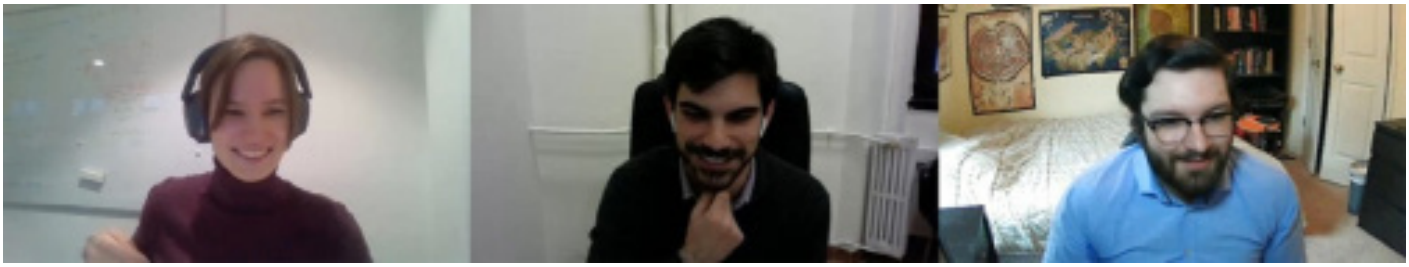
▲ *YOUNG* Online Seminar Series on February 1, 2021, with presentations from *C. Molero-Río* (Universidad de Sevilla, Spain), *Dr. A. Jiménez Cordero* (Universidad de Málaga, Spain), and *C. Lawless* (Cornell University, USA).

We invite the Operational Research community to register to receive news from the Online Seminar Series. We also invite the community to enjoy the video recordings of the presentations available at the YouTube channels from *IMUS* and *NeEDS*. As said in one comment to a LinkedIn post from the Online Seminar Series, this is *"A great resource Dolores Romero Morales, nice to be able to watch back".*

The Online Seminar Series has been widely advertised by *EURO*, *ALIO*, and *IFORS*, and this support is highly appreciated by the organizers!

▲ *Prof. G. Shmueli*, National Tsing Hua University, Taiwan, talking at Online Seminar Series *NeEDS* on *"Improving" Prediction of Human Behavior Using Behavior Modification".*

Prof. Emilio Carrizosa is Professor of Statistics and Operations Research at IMUS-Instituto de Matemáticas de la Universidad de Sevilla, Spain; *Prof. Dolores Romero Morales* is Professor of Operations Research, Copenhagen Business School, Frederiksberg, Denmark; *Kseniia Kurishchenko*, PhD student, Copenhagen Business School, Frederiksberg, Denmark; *Cristina Molero-Río*, PhD student, IMUS-Instituto de Matemáticas de la Universidad de Sevilla, Spain.



▲ *YOUNG* Online Seminar Series on February 22, 2021, with presentations from *K. Kurishchenko* (Copenhagen Business School, Denmark), *Dr. B. Manca* (Università di Cagliari, Italy), and *M. Morucci* (Duke University, USA).

ORSC's National Conference 2020 Successfully Held in Hefei, China - With a record high of 900 attendees

Degang Liu <dliu@amt.ac.cn>; **Xiaodong Hu** <xdhu@amss.ac.cn>

▲ All-together picture of *ORSC2020*.

The *15th Biennial National Conference of the Operations Research Society of China* (*ORSC2020*; http://orsc2020.csp.escience.cn) was held in China's central hub city of Hefei (with local organizer from University of Science and Technology of China; https://www.ustc.edu.cn/) during October 15-18, 2020. About 900 participants attended *ORSC2020*, this set the highest record.

Highlights of the 3-day conference included plenary speaker sessions, thematic parallel sessions, ORSC prize competitions, and election and board meetings. The invited on-site speakers on October 16 included *Prof. Lixin Tang* (Northeast University) on *"Data Analytics and Optimization for Smart Industry"*, *Dr. Gong Zhang* (Huawei Institute) on *"When Shannon Met Kantorovich, Challenges of the Optimization in the era of Interconnection"*, *Prof. Haitao (Tony) Cui* (University of Minnesota, USA) on *"Incorporating Human Behaviors into Operations Management/Research"*, *Prof. Xu Guo* (Dalian University of Technology) on *"Progress of Several Challenging Problems in Structural Topology Optimization and Related Research"*, and *Prof. Hao Hao* (Shanghai Polytech University) on *"Reverse Logistics and Applications"*. Three invited speakers from outside of mainland China gave their online presentations through Tencent Meeting because of COVID-19 travel restrictions. They are *Prof. Maria Grazia Speranza* (University of Brescia, Italy, and the President of IFORS) on *"Trends in Transportation and Logistics"*, *Prof. Jianqing Fan* (Princeton University, USA) on *"Analysis on Deep Q-Learning"*, and *Prof. Defeng Sun* (Hong Kong Polytechnic University) on *"Convex Composite Quadratic Programming: A Restricted Wolfe Dual and Symmetric Gauss-Seidel Decomposition Theorem"*.

ORSC has 16 special interest groups. Each one recommended 3 thematic session speakers on topics of intelligent computation, decision theory and methods, computational system biology, operational management, health management, graph theory and combinatorics, uncertain systems, reliability, financial engineering, behavioral *OR*, continuous and discrete optimization, statistics and stochastic optimization, game theory, and smart industrial data analysis. In these presentations, growing research interests have been seen in solving practical problems in such as courier and logistics, smart transportation, manufacturing, artificial intelligence, and data mining, and so on.

▲ *ORSC* research prize winners at *ORSC2020: Prof. Jianqiang Hu* and *Prof. Liwei Zhang*.

ORSC research prize was awarded to *Prof. Jianqiang Hu* of Fudan University, Shanghai, due to his achievements on stochastic discrete event system simulation and system sensitivity analysis and to *Prof. Liwei Zhang* of Dalian University of Technology on stability of optimization and applications in algorithm convergence analysis. The presented their latest research results during the plenary sessions. An *ORSC* life-time contribution award goes to *Prof. Guanghui Xu* of Chinese Academy of Sciences, who works on queueing theories and served president of *ORSC* and the Vice President of *IFORS* and *APORS* in the 1990s.

After severe competition, the *ORSC Awards for Young Researcher* goes to 5 active young *OR* researchers under the age of 40. They are *Bo Jiang*, Shanghai University of Finance and Economics, *Yongtang Shi*, Nankai University, *Zi Xu*, Shanghai University, *Dacheng Yao*, Chinese Academy of Sciences, and *Jin Zhang*, Southern University of Science and Technology.

OR applications have long been encouraged by the society. *OR* application prizes have been set up in 2002 for the projects using *OR* methods and techniques in solving practical problems. According to evaluation criteria similar to the *IFORS OR for Development*, an application project must show its use of OR and achievements in social and economic benefits. After a special session presentations and cross examinations, three projects were awarded for best OR practice teams represented by: *Prof. Feng Chen*, Shanghai Jiaotong University, on development and implementation of DSS system for vehicle logistics intelligent dispatching, *Prof. Dongdong Ge*, Shanghai Cardinal Operations, on application of large-scale MP solver COPT, and *Prof. Wenxing Zhu*, Fuzhou University, on layout of very large-scale integrated circuits and related issues. The three teams presented their projects during the conference, which was open to all interested audiences.

▲ *ORSC2020:* The 11th board meeting of *ORSC*.

▲ *ORSC2020:* The Award for *Young Researcher* winners.

During the conference, *ORSC* elected its new board. Prof. Yuhong Dai from Academy of Mathematics and Systems Science, Chinese Academy of Science, was elected as President of *ORSC* for 2021-2024. The new board meeting was held.

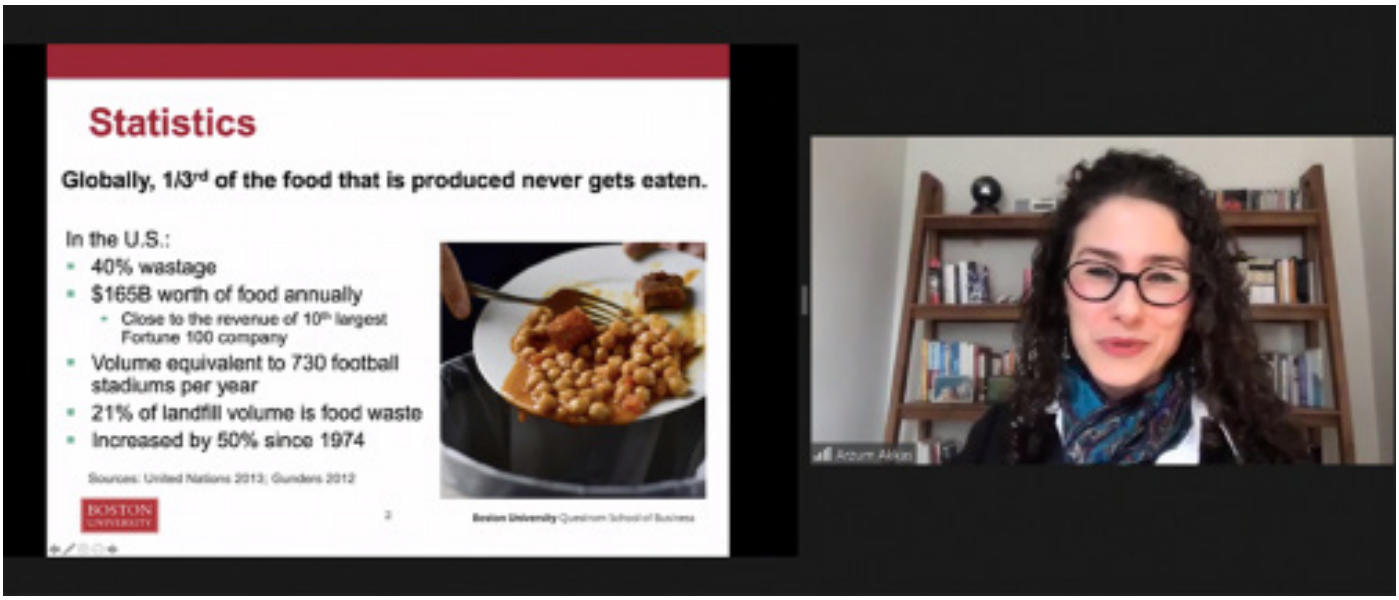
▲ *ORSC2020:* Transfer of *ORSC* presidency from *Xiaodong Hu* to *Yuhong Dai*.

The *Operations Research Society of China* (http://www.orsc.org.cn) convenes national meeting every two years usually in October. It was lucky there was a time window between September to November in 2020 when COVID-19 restrictions and social distancing were eased in mainland China; only several few places in Shandong had a small surge in cases. And there was a big surge later after the conference from December in Hebei until the lunar new year of 2021. During the pandemic from early 2020, *ORSC* launched its weekly online seminars since late April. Each seminar invites one or two Chinese or international speakers to present their latest research results. So far, a total of 51 such seminars have been organized.

▲ *ORSC2020:* "Cardinal Operations" wins the *ORSC* application prize.

Avoing food waste with better planning tools - Digital Meeting of EWG Retail Ops: Avoiding Food Waste

Sandra Transchel <Sandra.Transchel@the-klu.org>; **Alexander Hübner** <Alexander.Huebner@tum.de>



▲ *Digital Meeting of EWG Retail Ops: Avoiding Food Waste:* Keynote speech by *Arzum Akkas* (Boston University, USA).

The purpose of the *EURO Working Group on Retail Operations*, denoted as *EWG on Retail Ops* (see EURO Working Group on Retail Operations (ewg-retail-ops.eu)) is to advance the development and application of Operational Research (*OR*) methods, techniques, and tools in the field of Retail Operations. The second digital meeting of the *EWG Retail Ops* took place on March 26, 2021, and almost 60 participants, from the USA, Asia and Europe, and was organized by *Sandra Transchel* (Kuehne Logistics University, Hamburg, Germany) and *Alexander Huebner* (Technical University Munich, Germany).

Food waste is one of the great social and environmental challenges of our time. About one third of the produced food goes uneaten, while still about 10% of the global population suffers from malnutrition. Moreover, each produced food contributes to greenhouse gas emissions and consumes valuable environmental resources. If the greenhouse gas emissions for wasted food are calculated as a country, it would be the third largest global contaminator. Hence, managing food production on a global scale becomes an imperative from an ecological, ethical and economical perspective. However, current approaches in supply chain management, and in particular in grocery retailing, are mainly designed to meet high customer service levels and provide full shelves with ever broader assortments. The growing product proliferation and potentially unnecessary high service levels (e.g., fully equipped fruit and vegetable shelves on Saturday evening) are inevitabley resulting in overstocks and food waste. Avoiding food waste as a social and environmental topic becomes more and more relevant for agricultural production, consumer goods manufacturing, retailing and food services, and in the end to feeding the entire world's population.

Operational Research methods are appropriate tools to contribute in reducing food waste as the talks the in the workshop have shown. Better planning of inventories across supply chian, better integration of technologies and data across partners, appropriate incentives and an alignment of service levels and oversupplies are few of the options that can be addressed with quantitative modeling. The workshop was composed of one keynote speech and three presentations from PhD students. *Arzum Akkas* from the Boston University (USA) gave the Keynote Speech on *"Reducing Food Waste: An Operations Management Research Agenda"*. *Professor Akkas* has shown in her talk how food retailers can prevent and reduce food waste with better planning.

Afterwards, it followed Tobias Winkler from Technical University Munich (Germany) who talked about *"The retailers perspective on food waste prevention"*, and *Navid Mohamadi* from the Kuehne Logistics University (Hamburg, Germany) who gave a presentation on *"Supply chain coordination for perishable products under "minimum life on receipt" (MLOR) agreements"*.

Finally, *Nicole Perez Becker* from University of Luxembourg presented her topic on "*Strategic Behavior and Inventory Decisions in the Presence of Waste Cost"*. Subsequently, all participants had the opportunities to meet the presenters in separate virtual breakout rooms for further elaboration on tools and techniques to reduce food waste.

The social and environmental pressure will lead to further invest into capabilities to better manage food supply chains. The workshop has shown that *Operational Research methods* can contribute a lot for avoiding food waste along the supply chain. The potential is however untapped and further reseach is clearly necessary.

The *EWG Retail Ops* plans further digital meetings this year. There will be a workshop on *Retail and Pandemics* in October 2020, and another one on *Retail and Digitalization* in December 2020. Details can be found on the groups' website: http://www.ewg-retail-ops.eu.

OR on the Sunny Side of Alps – SOR Conferences in Slovenia: Cheerful Events in the Course of Times!

Mirjana Kljajić Borštnar <mirjana.kljajic@um.si>; **Samo Drobne** <samo.drobne@fgg.uni-lj.si>

▲ *Organizers* of *SOR* Conferences: The Slovene Society *Informatika*; University of Maribor, Faculty of Organizational Sciences; University of Ljubljana, Faculty of Mechanical Engineering.

The International Symposium on Operations Research in Slovenia (https://sor.fov.um.si/) is a central scientific event in the field of OR, held every two years under the auspices of the *Slovene Society Informatika*, the *Charter for Operations Research*, jointly with the *University of Maribor, Faculty of Organizational Sciences* (www.fov.um.si; Kranj, Slovenia), and the *University of Ljubljana, Faculty of Mechanical Engineering* (www.fs.uni-lj.si; Ljubljana, Slovenia). Over the years, it has attracted a growing international scientific community and works particularly closely with the *Croatian Society for Operations Research*.

▲ *Participants of the SOR'17 visiting the famous Planica ski jump centre (photo: courtesy of Dr. Samo Drobne).*

Since 2013 the conference has been held in one of the greenest part of Europe – *Bled, Slovenia*. Over the past decade, conference papers have grown steadily. At *SOR'13* there were 56 papers by 102 authors; at *SOR'15*, 93 papers by 102 authors; at *SOR'17*, we had 97 papers by 184 authors; and at *SOR'19*, 106 papers were authored by 203 researchers. Most papers came from Slovenia, Croatia and neighbouring regions, like Czech Republic, Hungary, Slovak Republic, Poland, Austria, Italy, Serbia, Bosnia and Herzegovina, but more and more authors come from all over Europe and the world. The COVID-19 epidemics has on one hand posed challenges to the scientific communities, organizing conferences has become difficult in terms of organization and travel, but on the other hand it provides opportunities to search for solutions even more connected than before, creating real virtual teams and forums and strengthening global cooperation even more.

This year's conference *SOR'21* will again be held in the beautiful green scenery of *Lake Bled* from September 22-24, 2021.

In terms of content, *SOR* provides an international forum for the publication of current research in the broad field of *OR*, covering a wide range of disciplines: mathematics, statistics, economics, engineering, education, environment, computer science and informatics, data science, artificial intelligence, high performance computing, and others. The methods of this diverse field are increasingly relevant today as they address today's complex problems and contribute to responsible decision making, planning, and sustainable use of resources. We are happy to see that our community is growing and is enriched by new participants from emerging fields, such as: sustainable development, digital transformation, data-driven decision making, artificial intelligence methods, and that these methods are more and more applied in various fields, such as tourism, agriculture, education, cyber-physical worlds, etc.

The main goal of the conference is to promote knowledge, interest and education in *OR* in Slovenia, in Europe and worldwide, in order to form the intellectual and social capital indispensable for the preservation of the identity of *OR*, especially at a time when interdisciplinary cooperation is proclaimed as significantly important for solving problems in the current challenging times. In addition, *SOR* is committed to interdisciplinary collaboration by joining *IFORS* and *EURO* and by supporting organizations such as *The Partnership for Advanced Computing in Europe (PRACE)*.

▲ *Beautiful Lake Bled with an island with church is where the conference takes place (photo: courtesy of Dr. Mirjana Kljajić Borštnar)*

SOR ladies at *SOR'19*: from left to right: *Prof. Dr. Mirjana Kljajić Borštnar, Prof. Dr. Lidija Zadnik Stirn* and *Mrs. Petra Gorjanc* (photo: courtesy of *Dr. Samo Drobne*).

The main driver of the conference for many years has been ***Prof. Dr. Lidija Zadnik Stirn*** (Biotechnical Faculty, University of Ljubljana, Slovenia). In addition to her active membership in *EURO* and *IFORS*, her vibrant personality and team spirit invites new opportunities for collaboration, creating a strong and engaged community. There are many other individual enthusiasts who selflessly support the conference. Even when they are not in the limelight, they are appreciated and indispensable. The success of past scientific events at *SOR* should be seen as a result of the combined efforts of multiple organizations and communities, great keynote speakers, and most importantly, the participants. And it is the participants who not only bring knowledge of scientific advances, but also share their special talents with the community.

During the *SOR'19* conference, *Prof. Dr. Tadeusz Trzaskalik* (University of Economics in Katowice, Poland) held the piano recital in the beautiful hotel lobby overlooking the *Lake Bled*.

We welcome you to join us at *SOR'21*, the International Operational Research in Slovenia!

SOR'19: *Prof. Dr. Tadeusz Trzaskalik* (University of Economics in Katowice, Poland) with his piano recital (photo: courtesy of *Dr. Samo Drobne*).

Towards a Social Technology of Strategic Choice - linking public policy worlds. Special Virtual Event to Celebrate John Friend's Strategic Choice Approach and a Birthday

Ian Mitchell <IanMitch1@gmail.com>

John Friend – received the *OR Society*'s Beale Medal in 2015, recognising a lifetime in practice with visiting chairs at 4 British universities. In 1964 *John* joined the *Institute for Operational Research*, established by the *OR Society* and the *Tavistock Institute of Human Relations*. He led a group engaged with the practicalities of local planning which developed the *Strategic Choice Approach*, moving *OR* from the idea of using mathematical tools on problems internal to an organisation to a sort of laboratory in which to forge new instruments to help people in working together to make decisions.

Presenters at the Special Virtual Event: *John Friend* and *Ian Mitchell*

2 December 2020 was *John Friend*'s 90th birthday. A virtual meeting celebrated this and considered how to carry his *Strategic Choice Approach (SCA)* forward.

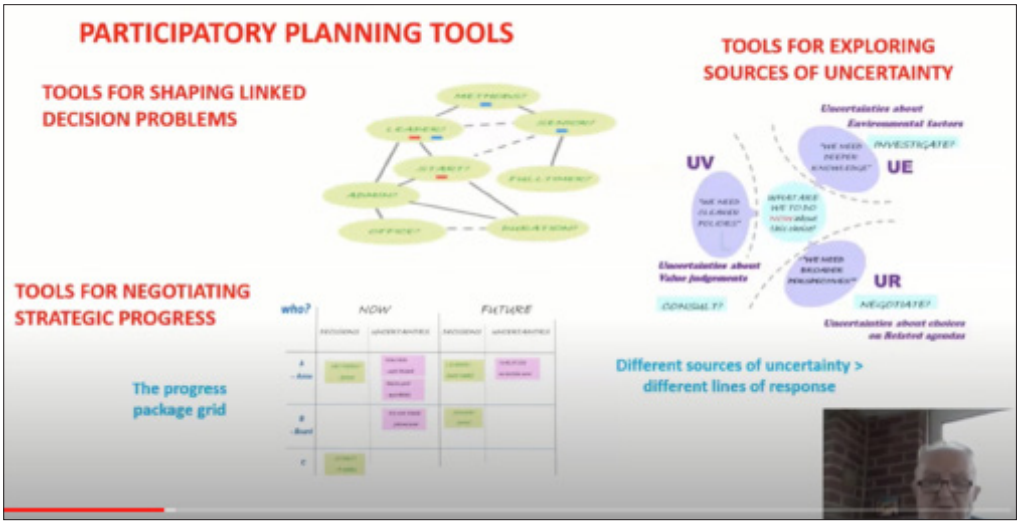
Ian Mitchell introduced *John* who described the approach; then experts from around the world described their case studies, priming small group discussions about what the SIG might do to carry this forward.

The book *"Local Government and Strategic Choice"* by *John Friend* and *Neil Jessop* described their experience of planning of Coventry between 1964 and 1967 from which their "Technology of Strategic Choice" emerged. I was struck by the similarities in processes of decision-making in Coventry with my experience on Salisbury District Council 40 years later and the classes of uncertainty complicating their choices:

"…uncertainties in knowledge of the present and future environment, uncertainties as to intentions in related fields of choice, and uncertainties as to appropriate value judgements" leading to demands for more investigation, more policy guidance and more co-ordination".

▲ Presenters at the *Special Virtual Event*: *Ruth Kaufman, Jonathan Rosenhead, Leroy White* and *Isabella Lami*

Ruth Kaufman noted how this OR method spread beyond the *OR* Community. *Jonathan Rosenhead* spoke on *John*'s successes in engaging people's values and exploring their uncertainties, furthering the tradition of pioneers like *J.D. Bernal*, to make the world better. *Leroy White* focused on the temporality of the strategic choice approach as a process, negotiating and resolving tension from different understandings, and the benefits of "stabilised for now" progress packages. *Isabella Lami* spoke on legitimising choices in the evaluation and delivery of urban renewal, for sustainable cities and communities, where architectural design depends on collectives of people, documents and space. She showed SCA+, new software combining problem structuring and MCDA enabling distributed shaping and designing.



▲ At the *Special Virtual Event*: *John Friend* presents the *tools* in the *Strategic Choice Approach.*

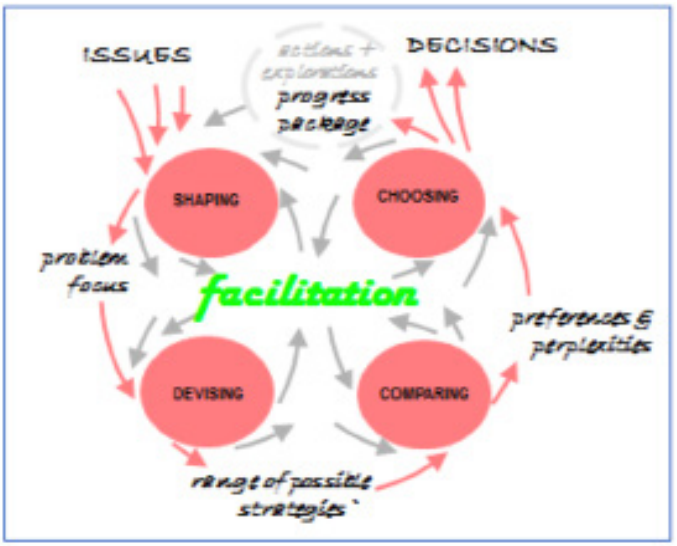
▲ Presenters at the *Special Virtual Event*: *Bryan Jenkins, John Friend* and *Ine Steenmans*

Bryan Jenkins described how the Strategic Choice Approach helped establish the 2009 Canterbury water management strategy in New Zealand's South Island through its 4 modes of shaping, designing, comparing and choosing, bringing in Kaitiakitanga, *"kye-tee-ah-kit-anga"*, Maori stewardship, leading to Immediate actions and explorations and deferred actions. The *Canterbury Water Management Strategy* is still running now more than ten years later.

Small group discussions via ZOOM rooms, on "What is to be done?" celebrated the success of the Strategic Choice Approach and its immense potential. The key challenge was to increase awareness of the approach among those who could most benefit from it. For 2021 a virtual Summer School for *OR* and Policy people was attractive. The Summer School could use a virtual format like the successful *OR62* conference, complemented by smaller scale tutorials.

We should experiment with the wide range of tools for facilitation available in the times in which we live, with less travel and loss of nuance in conversation. *Ine Steenmans*, chair of the SIG, noted that much of the original work of the Strategic Choice Approach has lasted over time but is often invisible when translated into the language of its clients. The *PPD SIG* only exists because of *John Friend's* work, so the onus is on us to understand the niche of the different activities and involve the relevant people.

John has shared a presentation, a one page synopsis and a paper on six related directions from his work at the OR Society Website.



▲ At the *Special Virtual Event*: The *Four Modes of Thought* in the *Strategic Choice Approach.*

The Mathematical Colloquium by Sunway University, Malaysia – A Blessing during the pandemic times

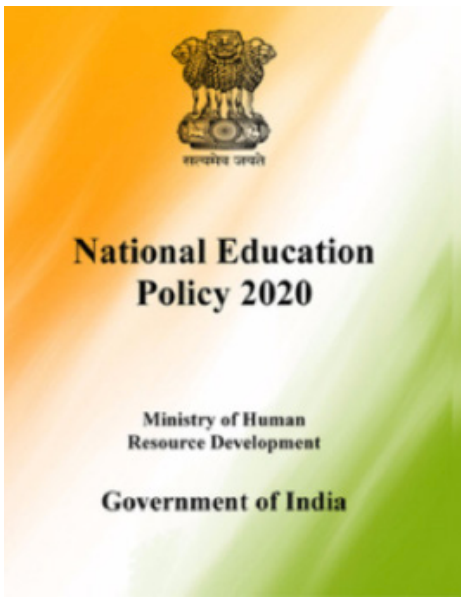
Jinal Parikh <jinal.parikh@ahduni.edu.in>
Gerhard-Wilhelm Weber <gerhard.weber@put.poznan.pl>

In its efforts to propagate and showcase the utility of Mathematics to solve real-time problems as also to promote its analytical rigor, the *School of Mathematical Sciences (SMS)* at the Sunway University, Bandar Sunway, Subang Jaya, Selangor, Malaysia (https://university.sunway.edu.my/sms) has been conducting *Mathematical Colloquia* on a continual basis beginning 2020. This colloquium series serves the purpose of a weekly and now a monthly conference by providing a suitable platform for academic experts and researchers to share their expertise and researches with academia and researchers across the globe. This colloquium series is spearheaded by *Prof. Dr. Teo Kok Lay*, one of the mentors of our worldwide *OR* community, and organized and conducted by his young colleague *Prof. Dr. Lee Mok Siang* as well as other faculty members and students of the *SMS*. The first author, *Dr. Jinal Parikh*, is grateful to the university, the organizing team and the co-author *Prof. Dr. Gerhard-Wilhelm Weber* for their encouragement and support and for providing her with an opportunity to present her work at the colloquium.

▲ Revisiting an exceptional experience at *EURO 2019*, Dublin: *Dr. Jinal Parikh* and *Dr. Gerhard-Wilhelm Weber*.

The ongoing COVID-19 pandemic has been a blessing in disguise for this colloquia series because it has provided a fascinating platform to experts and speakers from the academic community from all over the world to share their cutting edge research on a diverse range of *OR* and mathematical topics as well as a forum to discuss and showcase several rigorous, novel and innovative applications of *OR* in addressing real-world problems. Nevertheless, it also provides an impetus to young and budding researchers to demonstrate their respective researches. *Dr. Jinal Parikh*, India is grateful to *Prof. Willi* who had heard her present her paper at the *EURO 2019* conference and had recommended her name to *Professor Teo Lay Kok* as a speaker for the colloquium.

At the colloquium, *Dr. Jinal Parikh* (Amrut Mody School of Management, Ahmedabad University, India) presented her research paper titled *"Mapping Perceptions of Universities of Higher Education in India: A Comparative Analysis using DEA and Quantile Regression"*. It was previously presented by her at the EURO 2019 conference. This presentation was the 14th in the series of the *Mathematical Colloquia* organized by the *Sunway University*. The paper focuses on mapping perceptions of *universities of higher education* in India which is one of the most crucial contemporary topics in India given that the *Government of India (GoI)* has not only undertaken massive structural and systemic changes in higher education but has also recently revised and announced *India's National Educational Policy-2020* (July 29, 2020) after 34 years. Given this background, the purpose of this paper was: a) to explore the factors influencing perceptions of Universities of Higher Education in India, b) to provide a novel behavioral *Operational Research* approach for assessing the relative input-output efficiency of universities of higher education in India using *Data Envelopment Analysis (DEA)* and *Quantile Regression (QR)* based on perceptions, and c) to compare and contrast the results obtained through *DEA* and *QR*. The sample of this study comprised of top 50 ranked higher education Institutions of India as per the *National Institutes Ranking Framework (NIRF)* framework, which has been approved by the *Ministry of Human Resource Development (MHRD)* at GoI. Currently, the NIRF framework is the only available metric used to map and rank institutions of higher education across India. The NIRF framework ranks various Institutions across India based on five parameters, viz.: Teaching, Learning and Resources *(TLR)*, Research and Professional Practice *(RP)*, Graduation outcomes *(GO)*, Outreach and Inclusivity *(OI)*, and Perceptions *(PR)*. While NIRF has assigned weightages of 30, 30, 20, 10 and 10 percentages to each of these parameters respectively, the author conducted *DEA* and *QR* on this data with PR as the output variable and *TLR*, *RP*, *GO* and *OI* as the input variables to corroborate these weightages assigned by NIRF.



▲ Cover page, *NEP 2020*.

The results showed disparities between both NIRF assigned weights and those obtained from *DEA* and *QR*; and between NIRF ranks and *DEA* efficiency scores. *DEA* optimal weights also demonstrated that different weightages of *TLR, RP, GO* and *OI* contribute differently to the formation of PR, implying that these factors influence the perceptions of universities differently. >>

▲ Campus of *Sunway University*, Malaysia. Source: https://university.sunway.edu.my/about-us.

>> At the micro level, this analysis of perceptions of universities may be used by universities to benchmark their processes by strengthening those inputs amongst *TLR, RPC, GO* and *OI* that contribute significantly in shaping positive stakeholder perceptions *(PR)*. At the national level, this analysis can serve as a base to indicate those inputs which contribute more significantly to the formation of perceptions of universities for them to be perceived better vis-à-vis others. This colloquium not only gave the author a suitable platform to display a novel use of *OR* techniques to solve behavioral issues which have policy implications at a broader level but will also be of immense value to the academia, research scholars and students.

The colloquium series has been witness to several other interesting and insightful researches covering a varied range of *OR* and Mathematics applications across different sectors by experts across the globe. To quote some – *Prof. Gerhard-Wilhelm Weber*'s research titled, *"Maximum Principle for Stochastic Optimal Control of a Markov Regime-Switching Jump-Diffusion Model with Delay - Application to Finance and Extension to Games"* (speaker from Poland), *Prof. Athanasios Yannacopoulos'* research titled *"Robust control for parabolic SPDEs with applications to resource management"* (speaker from Greece), *Prof. Cheng-Chew Lim*'s research titled *"Energy management and optimisation in fuel cell vehicles"* (speaker from Australia), *Professor Fusheng Bai*'s research on *"Surrogate Optimization for Computationally Expensive Black-box Functions"* (speaker from China), *Prof. Ioannis Baltas*'s research titled *"Robust Stochastic Optimal Control for Defined Contribution Pension Funds"* (speaker from Greece), and many more.

The academic experts present during each presentation bring in a lot of new insights for the researches as well as enrich them by enlightening the speakers with their knowledge. A constructive *Question-and-Answer* round after each presentation is useful to gather more knowledge as to how to strengthen the researches further in terms of their methodology, contents as well as outcomes. This colloquia series, thus, serves the noble purpose of being a highly motivating platform for the *OR* and Mathematics community to present, enhance and learn about analytically rigorous and novel Operational Researches.

This colloquia series which started as a weekly phenomenon during the pandemic is now organized twice a month starting January 2021. Virtual conferences like these not only play the quintessential role of spreading the importance and application of *OR* & Mathematics but will also certainly play the decisive role of shaping its future. The authors are grateful to the *Sunway University* and wish the colloquium series all the very best to keep the spirit going and organize many more such colloquia for the advantage of our entire community as it embarks on its 28th colloquium on March 26, 2021.

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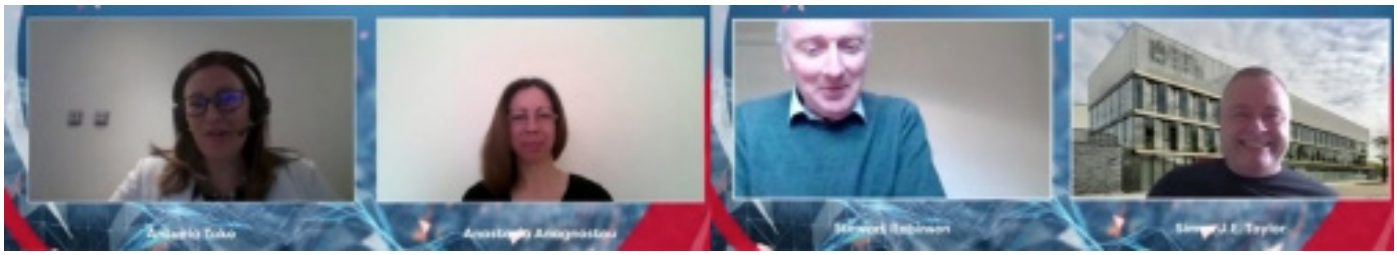
1. National Institutional Ranking Framework, Ministry of Human Resource Development, Government of India website, https://www.nirfindia.org/about.

2. National Education Policy - 2020, Ministry of Education, Government of India website, https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf.

3. Sunway University, Malaysia website, https://university.sunway.edu.my/about-us.

10th Operational Research Society Simulation Workshop 2021, UK, Successfully Held Online

Anastasia Anagnostou <anastasia.anagnostou@brunel.ac.uk>
Antuela Tako <a.takou@lboro.ac.uk>



SW21 Welcome session with *Conference Chairs* and *Founders* of the *Simulation Workshop Series* (from left to right: *Antuela Tako* and *Anastasia Anagnostou*; *Stewart Robinson* and *Simon Taylor*).

What a fantastic virtual conference we have had!

The *Operational Research (OR) Society's Simulation Workshop* is a biennial conference held in cooperation with the *INFORMS Simulation Society*. It brings together practitioners and academics working in the field of modelling and simulation, offering an opportunity to exchange ideas on the current and future state-of-the-art in modelling and simulation. This time we met after three years due to the postponement of SW20 that was originally planned to take place in March 2020 at Loughborough University in the UK. *SW21* was held online over 5 days, March 22-26, 2021. We were pleasantly surprised by the number of delegates that joined us at the conference. *SW21* was attended by 130 academics and practitioners from all over the world.

The *SW21 Programme* included three plenary sessions:

• The **Presidential Address** where the President of the UK's OR Society, *Professor Edmund Burke* (University of Leicester, UK), chaired a presentation by the winners of the *Tocher Medal 2018-2019* (KD Tocher Medal - The OR Society);
• ***SW21 EDI Plenary "Celebrating Equality, Diversity & Inclusion in Simulation: Interview with Professor Sally Brailsford"*** inspired by Sally's recent recognition in the Stanford University's new Database of Top 2% Scientists in the World 2020. This was an opportunity for us to discuss with Sally the past, current and future state of diversity and inclusion in *OR*;
• ***"Writing Winning Simulation Papers"***: Two of the editors of the Journal of Simulation, *Professor Christine Currie* (University of Southampton, UK) and *Professor John Fowler* (Arizona State University, UK), gave the audience tips on how to write winning simulation papers.

SW21 Keynote Speakers: Professor Susan Sanchez (Naval Postgraduate School, USA) and *Professor Young-Jun Son* (The University of Arizona, USA).

The conference started with the SW21 welcome session. The conference chairs in the picture below *Antuela Tako* (Loughborough University, UK) and *Anastasia Anagnostou* (Brunel University London, UK) welcomed the delegates and provided an orientation to the conference, followed by the founders of the workshop series, *Professor Stewart Robinson* (Loughborough University, UK) and *Professor Simon J.E. Taylor* (Brunel University London, UK) who told us about the history of the simulation workshop and how all started in a bar in San Diego!

Two *SW21* Keynote Speakers, shown in the picture below, *Professor Susan M. Sanchez* (Naval Postgraduate School, US) and *Professor Young-Jun Son* (The University of Arizona, US), inspired the audience with their outstanding work on data farming and dynamic-data-driven, adaptive multi-scale simulation, respectively.

The *SW21 Programme* also included seven tutorials, led by experts in the simulation field. The topics varied from basic simulation skills such as verification and validation, agent-based simulation, system dynamics, to more specialist topics such as optimisation via simulation, hybrid simulation, facilitated simulation and text analytics for simulation. There were 35 contributed papers presented at the conference. The presentations were varied and covered a wide range of interesting topics, including - to name a few: simulation for COVID-19; agent-based simulation, simulation practice, conceptual modelling, simulation methodology, simulation optimisation, simulation in healthcare and more. >>

>> The conference also included two very successful poster presentation sessions. In the *Lightning Poster Plenaries*, 15 poster presenters gave a 2-minute pitch to advertise their poster, followed by an interactive poster session where delegates had the opportunity to visit each poster and discuss the work with the authors.

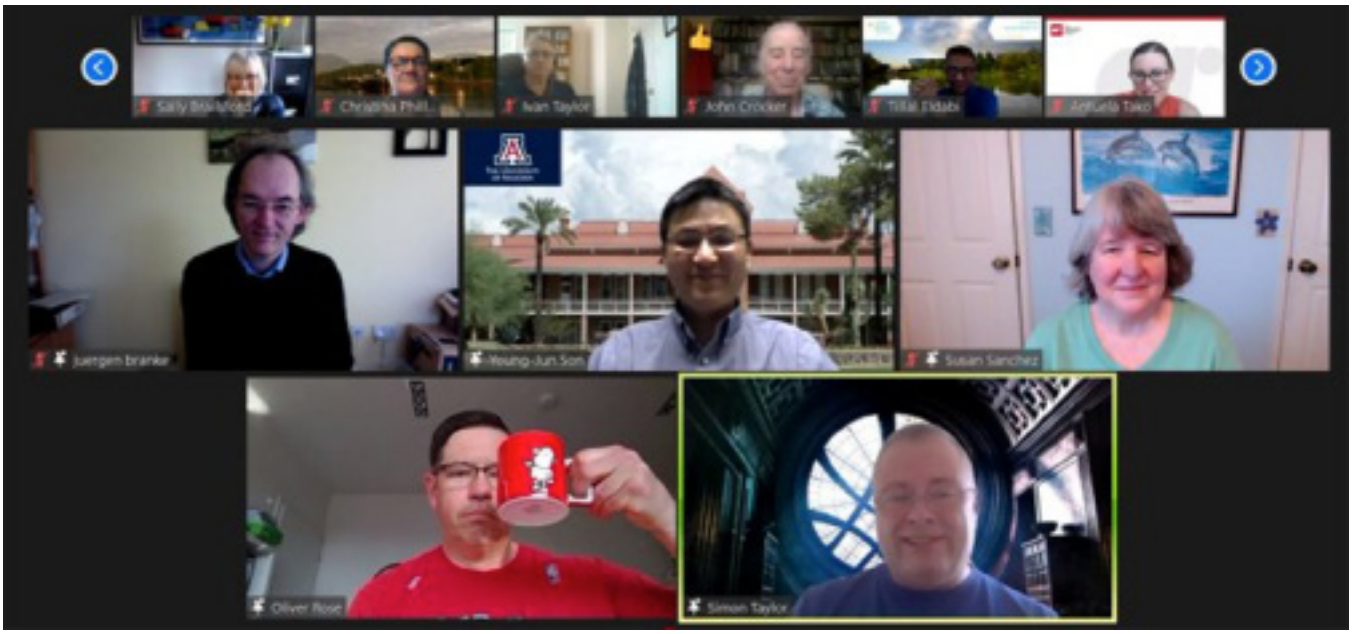
There was also a hands-on Safari modelling competition, and a wide range of networking events were the delegates had the opportunity to discuss their recent research, exchange ideas, develop collaborations and meet with other delegates in a relaxed and friendly environment. To name just a few of our social events, we held a Speed Networking session, a Virtual Pub Quiz and Relaxation and Meditation sessions.

▲ *SW21* EDI Plenary *"Celebrating Equality, Diversity & Inclusion in Simulation: Interview with Professor Sally Brailsford"* (*session conveners,* from left to right: *John Fowler* and *Antuela Tako; Sally Brailsford* at the bottom of the picture).

The conference ended with the *SW21 closing panel discussion* titled: *"Artificial Intelligence and Simulation: Friend or Foe?"*, chaired by *Professor Simon J.E. Taylor* (Brunel University London, UK) with four distinguished panellists: *Professors Young-Jun Son* (The University of Arizona, USA), *Susan M. Sanchez* (Naval Postgraduate School, USA), *Oliver Rose* (Universität der Bundeswehr München, Germany) and *Juergen Branke* (Warwick Business School, UK). The panellists debated whether Artificial Intelligence and Simulation are Friend or Foe.

The conference was a great success, and it was deemed as an excellent virtual event. The delegates commented very positively about the high quality of the programme. Readers can find more about the *SW21* programme in the following link: Simulation Workshop - The OR Society.

We would like to thank the *Organising Committee*, the *sponsors* and *everyone who attended and contributed to SW21* for helping make it a great success. Finally, we offer our *congratulations* to ***SW21 award*** and ***prizes winners***: ***Best Paper Award*** to *Matthew Windeler, Michael Higgins* and *Giles Thomas* (Ford Motor Company, UK) for the paper "*Supporting the Ventilator Challenge During the COVID-19 Pandemic with Discrete Event Simulation Modelling"*; ***Best Poster Prize*** to *Stacey Croft* for the poster *"Your call is important to us: Using discrete event simulation to plan telephone staffing at a GP practice"*; ***Best Poster Prize Honourable Mentions*** to *Luke Rhodes*-Leader for the poster *"Empirical Evaluation of Simulation-Based Operational Decisions"* and to *Anastasia Anagnostou* for the poster *"Simulation Modelling and AI for Pandemic Crisis Management: The STAMINA Predictive Modelling Toolset"*; ***Safari modelling Competition Winning team***: *Team OptiSim (Sally Thompson, Paul Glover, Laura Hannula* and *Luke Rhodes)*; ***Safari Modelling Competition Runner up team***: *Team Grizzly (Clayre La Trobe, Mary Conlon, Syaribah Brice, Ainhoa Goienetxea* and *Tillal Eldabi*), and ***Pub Quiz winners***: *Stewart Robinson, Roger Brooks, Graham Laidler* and *Laura Hannula.*

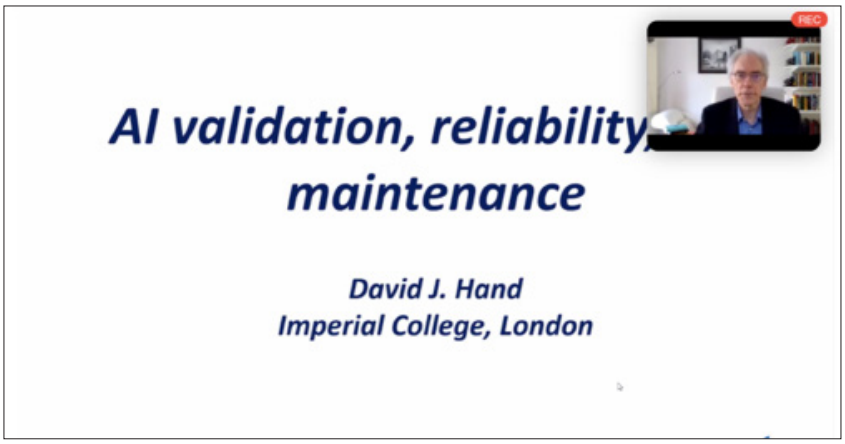


▲ *SW21 Closing Panel Discussion:* "Artificial Intelligence and Simulation: Friend or Foe?"
(from left to right: *Juergen Branke, Young-Jun Son, Susan M. Sanchez,* then *Oliver Rose* and *Simon J.E. Taylor*).

Delving into Analytics, OR and AI – The Analytics Summit 2021 of the OR Society, UK

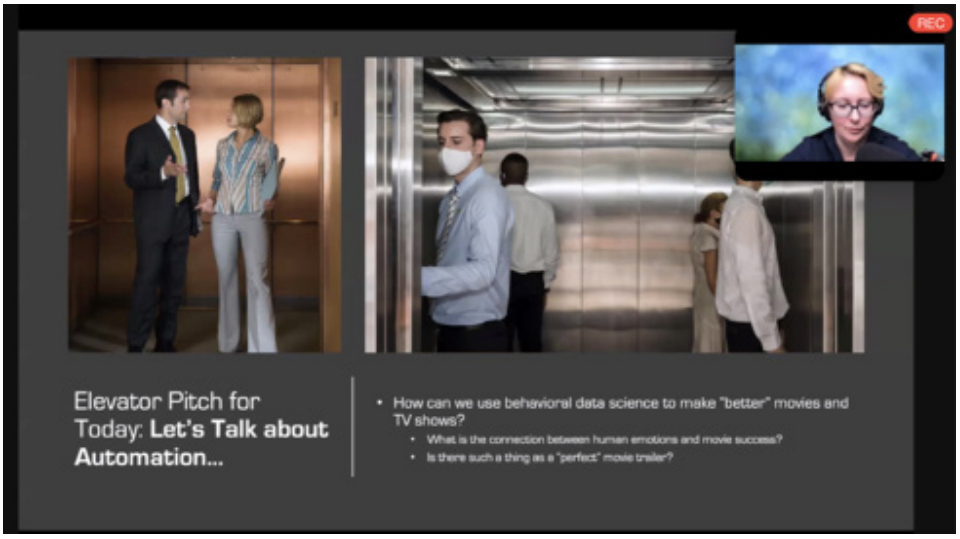
Nigel Cummings <nigel.cummings@theorsociety.com>

Our *annual Analytics Summit* event gives attendees the tools and skills to drive business results with their data and provides them with the latest developments affecting analytics, *OR* and *AI* (https://www.theorsociety.com/events/analytics-summit/). This event was organized by the *OR Society* of the UK (https://www.theorsociety.com/).



Analytics Summit 2021: plenary lecture by *Prof. Dr. David Hand* (Senior Research Investigator & Emeritus Professor of Mathematics at the Imperial College London).

The *OR Society* is a member-led organisation supporting professional operational researchers across industries and academia. We promote the understanding and use of operational research in all areas of life, including industry, business, government, health and education. The society is a registered charity which does everything from helping *OR* specialists push the boundaries of the discipline through publications and events to undertaking outreach work aimed at helping everyone from business leaders to schoolchildren find out about the benefits of *OR*.



Analytics Summit 2021: keynote lecture by *Prof. Dr. Ganna Pogrebna* (Lead for Behavioural Data Science at the Alan Turing Institute).

The event was held virtually and attended by lots of analysts eager to gain key insights from experts in government, industry, and academia, to share with their businesses.

The Keynote Talk was given by *Prof. Dr. David Hand* and concerned AI validation, reliability, and maintenance. It presented a view of requirements for valid, reliable, and robust AI systems. It started with *Professor Hand* defining the purpose of "the system", and then he examined the risks arising from inadequate data and made suggestions of how to overcome them.

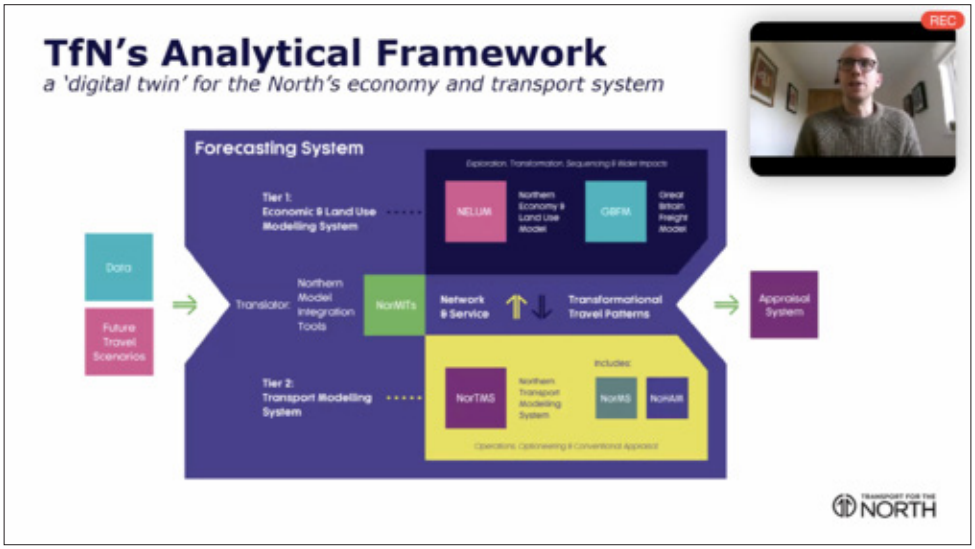
His talk moved on to discuss the challenges, in practice, that arose from the fundamental non-stationarity of the world. *Prof. Hand* also spoke about the need for AI systems to work in a human social context and the need for systems to work effectively in an AI context, especially as he believes the internet of things (IoT) is becoming more dominant.

Prof. Dr. Ganna Pogrebna, Professor of Behavioural Economics and Data Science at the University of Birmingham and a Fellow at the Alan Turing Institute, provided information about improving productivity and the customer experience in the entertainment industry.

The entertainment industry relies heavily on a consumer-centric framework that puts customers at the centre of content development and production. >>

Analytics Summit 2021: keynote lecture by *Marilena Karanika* (Head of Categorisation at Experian/Castlight).

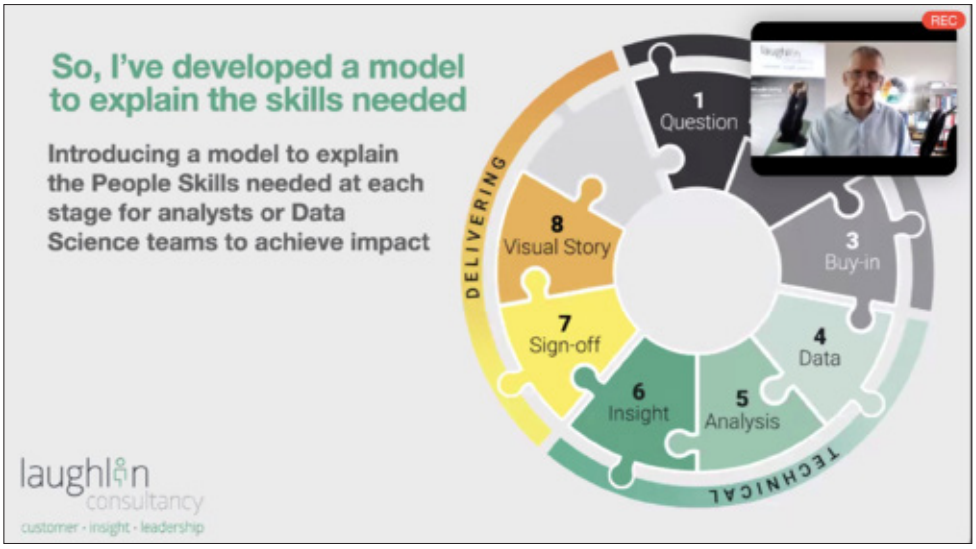
>> Data science using natural language processing, image recognition and sound analytics, combined with econometric analysis, can explore the extent to which human emotions, imagery, and audio shaped consumer preferences for media and entertainment affects content.



▲ *Analytics Summit 2021*: keynote lecture by *Dr. Jack Snape* (Principal Analyst at Transport for the North).

Marilena Karanika, Head of Categorisation at Experian/Castlight, spoke about categorisation in the age of Open Banking. The Open Banking initiative presents opportunities for consumers to use their transactional data to access better financial products and services. It also helps businesses to improve their decision-making processes by providing their customers with the best possible experience.

Paul Laughlin, Managing Director of Laughlin Consultancy, related how, after 20 years of experience in creating and leading data & analytics teams, he had now reached a point where he primarily focussed on helping other leaders master "the people side of data and analytics".



▲ *Analytics Summit 2021*: keynote lecture by *Paul Laughlin* (Founder and Managing Director, Laughlin Consultancy).

Paul explained how he published both academic research and opinion pieces based on his commercial experience. These included chapters in books such as *"The Dark Side of CRM"* and numerous articles in journals, including *"The Bottom Line"*.

Dr. Jack Snape, Principal Analyst at Transport for the North, provided insight about methods for making sense of simulated worlds, using the principles of predictive analytics to make complex simulation models more usable. Simulation models are moving closer to realistic levels of detail and are now being linked together into complex ecosystems. Such connection and linkage are necessary to understand interactions between sectors, such as transport, land-use, and electricity generation.

Jack, who has a PhD in physics and has worked as an analyst in the Civil Service and Local Government across a range of policy areas, shared his experiences using predictive analytics principles to make complex modelling ecosystems more usable.

The *Analytics Summit 2021*, despite the limitations imposed by the COVID-19 pandemic, proved to be a triumph in steering and informing those who attended toward new and reliable paths to take in analytics.

We hope that our next Analytics Summit will be back to a physical event and can't wait to share the latest developments in the field then.

▲ *Analytics Summit 2021*: keynote lecture by *Mark Somers* (Founder and MD, 4most).

WOMBAT 2020: Celebrating Optimization and OR in Australia and Worldwide

Alexander Kruger <a.kruger@federation.edu.au>

▲ *WOMBAT 2020*: One of conference photos as a mosaic.

2020 was a special year. As traditional face-to-face meetings became impossible, we are witnessing an explosion of online activities.

Mathematics of Computation and Optimisation (MoCaO) group of the *Australian Mathematical Society* made a difficult decision to conduct the *"5th annual Workshop on Optimization, Metric Bounds and Transversality" (WOMBAT)* in the fully *online mode*. For those not familiar with Australian fauna, *wombat* is a cute Australian animal.

The fifth instalment of the workshop took place November 30 - December 4, 2020, 4. It was dedicated to the memory of *Prof. Alexander Rubinov* (1940 - 2006) on the occasion of his 80th birthday. *Alexander Rubinov* made significant contributions to many areas of mathematics including optimization and *OR*. He was Founding Director of the *Centre for Informatics and Applied Optimization (CIAO)* at the University of Ballarat and the first *EUROPT Fellow*.

Because of the large number of participants coming from different time zones, the talks were scheduled in three clusters: morning, afternoon, and night from 9:00 am to 9:30 pm (Australian Eastern time).

The first day of the workshop was entirely dedicated to *Alexander Rubinov*. It started with a memorial session in the morning where *A. Rubinov's* former colleagues, friends and students shared their memories. The session was opened by a keynote presentation by *Prof. Barney Glover*, Vice Chancellor of the Western Sydney University, who had been Deputy Vice Chancellor of the University of Ballarat in the late 1990s, had taken part in establishing CIAO, and also collaborated with *Alexander Rubinov* in his optimization research. As not all *A. Rubinov's* former colleagues from overseas were able to speak live at the memorial session, several pre-recorded video-messages were presented. The afternoon session included four research talks on topics directly related to *A. Rubinov's* interests.

The evening session was reserved for the annual *Rubinov Memorial Public Lecture*. Federation University Australia (formerly University of Ballarat) had been running this series of public lectures by prominent mathematicians since 2008. The last one, for the first time, made part of the annual *WOMBAT* and, as it was delivered online, attracted a much larger audience from around Australia and overseas. The lecture *"The Forgotten Geometry of Mesopotamia: Revelations from an Ancient Clay Tablet"* was delivered by *Dr. Daniel Mansfield* from the University of New South Wales, Sydney, Australia.

On the other days, there were keynote and contributed talks. Unlike traditional conferences and workshops, the *5th WOMBAT* focused on discussions around several optimization and OR topics of general interest, led by recognized experts in the field: *Prof. Asen Dontchev* (University of Michigan, USA), *Prof. Claudia Sagastizábal* (University of Campinas, Brazil), *Prof. Hong-Kun Xu* (Hangzhou Dianzi University, China), and P*rof. Didier Henrion* (University of Toulouse, France).

Altogether, there were 50 keynote and contributed talks. The program of the workshop and recordings of all presentations can be accessed at https://wombat.mocao.org/

The unusual online mode of the workshop was reflected also in a new way of taking conference photos. It was impossible to gather all the participants in a single photo. The next one presents a portion of the participants in one of the sessions.

Links on EUROPT Fellowship:

https://www.euro-online.org/websites/continuous-optimization/europt-fellows/,
http://www-optima.amp.i.kyoto-u.ac.jp/ORB/issue22/europt_fellow.html,

Multiple *q* and Investment in Japan

by **Kazumi Asako, Jun-ichi Nakamura, Konomi Tonogi**

Springer, Singapore
ISBN 978-981-15-2980-1/hbk; 978-981-15-2981-8/ebook.
xii, 184 p. (2020). 91-02 91G50
https://link.springer.com/book/10.1007%2F978-981-15-2981-8.

Operational Research for Economics for Tomorrow

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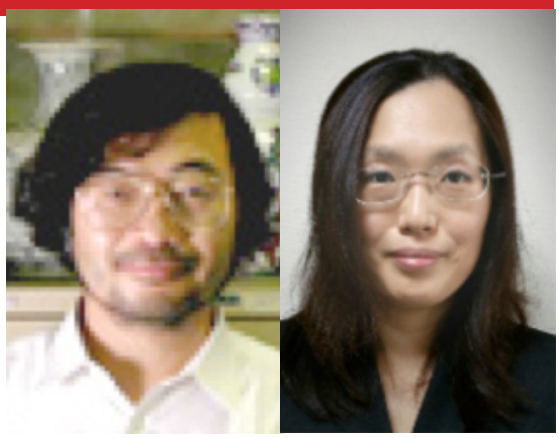
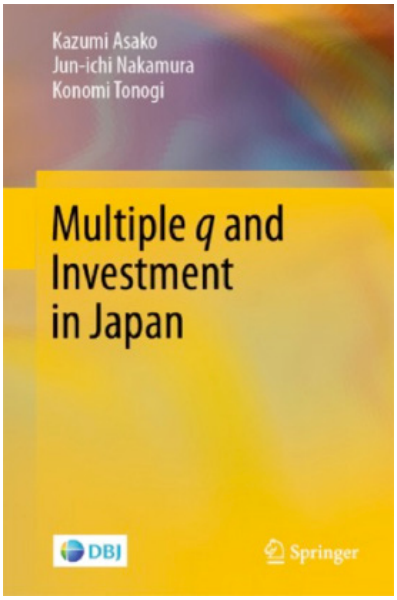


▲ The 1st and 3rd coauthors (from left to right): *Kazumi Asako* and *Konomi Tonogi*.

The book by *Kazumi Asako*, *Jun-ichi Nakamura* and *Konomi Tonogi* is a valuable contribution by as well as to mathematics and statistics, Operational Research (*OR*) and Analytics. It was prepared for the sake of our economies and the participating societies, with all their diverse characteristics and sizes, and eventually for all their citizens

In the investment theory by *Tobin* (1969), which became known as *Tobin's q theory*, *q* is defined as the ratio of the firm's market value to the total cost of replacing the capital stock held by that firm. This ratio is observable in actual data and is called the *"average q"*. Whenever $q > 1$, capital investment is conducted since in the market real investment is evaluated more highly than its cost, i.e., real investment offers a higher advantage than the holding of equities. According to neo-classical microeconomics of firms, the average *q* has to be replaced by the *"marginal q"*. The latter value is the imputed price of capital measured in investment goods and defined as the ratio of the marginal enterprise value gained from implementing 1 unit of investment to the replacement cost of the marginal unit of capital stock. However, this lacks a mechanism for determining the investment's volume. A possible way to fulfill this need is to employ the adjustment cost of investment.



▲ *Economics for Tomorrow.* With *Operational Research.*

This work is rigorous theoretically and relevant practically. With its usage, in following years the youth of economics and management science, mathematics and notably Operational Research, may become better educated and trained. What is more, novel investigations might be performed and real-life applications conducted in the quickly growing fields of research on related micro- and macro-worlds, for the sake of our modern industries, our natural environment, and perspectives of humanity and of all life.

The authors of this book enjoy a long-ranging high and increasing reputation, due to their powerful and analytically rigorous study work which covers several decades, in Japan but with a strong recommendation also to the other nations and countries in the world. Indeed, these are the so-called developed but also the emerging and developing countries. Herewith, this book is another academic achievement by the authors, and it is founded on their remarkable knowledge and experience in mathematics and statistics, and in making them operational. Actually, this research book and compendium also contributes to modern mathematics in return.

The presented novel and, indeed, unique book appears to its readers as an offer and a promise of various benefits, too. The readers and benefiters may be from educational institutions, research institutions, corporations of modern industries, including finance and trade, micro- and macro-economic institutions, developmental and political deciders, planners and coordinators of any levels, contents and directions.

In this book, advancements in capital investment in the course of a long time from both theoretical and empirical perspectives are conducted. Micro-data at the business environment level in Japan are examined and new observational findings are obtained alongside the studies from different regions too. Investigations started with Tobin's q theory for empirical studies but in this way the expectations could not be fulfilled. In order to overcome this deficiency, several theoretical models are offered by the authors. Other empirical analyses are considered so as to within the framework of Multiple q models deeply understand deeply and improve the perspective of capital investment behaviors in Japan. Additionally, the heterogeneity of capital stock and investment approaches are considered in some of the chapters as well.

The authors investigate Multiple q models to deeply root their - and eventually our all - knowledge about investment behaviors. But rather than restricting themselves to their home country, the book's major emphasis and exemplification of the capital investment, its development and research, are on Japan. They also observe that the inconsistency between the theory and the empirical performance of Tobin's *q* models is not yet finally removed by Multiple *q* models

▲ Ministry of Economy, Trade and Industry (METI) of Japan is taking a variety of measures to promote foreign direct investment in Japan (cf. https://www.meti.go.jp/english/policy/external_economy/investment/index.html).

Some words on word-famous and highly respected Japan's economy seem to be worthwhile at this point. The following data mostly are from before the COVID pandemic. Like everywhere in the world, the figure are expected to look differently in the era thereafter. Japan has the 3rd largest national economy in the world, after the USA and China, in terms of nominal GDP, and the 4th largest national economy in the world, after the USA, China and India, in terms of purchasing power parity as of 2019. Japan's labor force consisted of 67 million workers, again as of 2019. Japan has a low unemployment rate of around 2.4 percent. Ca. 16% of its population were below the poverty line in 2017. Japan today has the highest ratio of public debt to GDP among all developed nations, with national debt at 236% relative to the GDP in 2017. In 2018, Japan's exports amounted to 18.5% of its GDP. Main export markets of Japan were the USA and China, as of 2019. Its major exports include motor vehicles, iron and steel products, semiconductors and auto parts. As of 2019, Japan's main import markets were China, the USA and Australia. Japan's major imports consist of machinery and equipment, fossil fuels and foodstuffs, chemicals and raw materials (cf. https://en.wikipedia.org/wiki/Japan). Foreign direct investment (FDI) flows into Japan remain low when compared to most other developed nations, and relatively unstable. FDI reached USD 14,5 billion in 2019, up from USD 9,8 billion in 2018, according to the 2020 *World Investment Report of UNCTAD*. FDI stocks in Japan were an estimated USD 222,5 billion in 2019. At the same time, Japan remained the world's largest investor (cf. https://www.nordeatrade.com/se/explore-new-market/japan/investment#:~:text=FDI%20flows%20to%20Japan%20remain,about%20USD%20222%2C5%20billion.).

The *q* theory, or *q* model, is a standard approach to how corporate investments behave. The *"q"* ratio is the firm's market value measured by its capital goods. Here, the investment rate is a linear function of only this ratio. Based on its presentation by *Tobin* (1969), alongside investment adjustment costs, q theory was introduced with a neoclassical micro-foundation. But the explanatory power of this theory when directly applied to actual investment data proved to be unsatisfactory almost uniformly. This book carefully discusses all the related foundations, disclosing the pros and cons of Tobin's q theory as well as of its extension called Multiple *q* theory along with its related models.

The 7 chapters of this book are these: *Chapter 1*: Survey of the Literature, *Chapter 2*: Augmentations to Multiple *q* Theory, *Chapter 3*: Construction and Summary Statistics of the Data, *Chapter 4*: Investment Behavior of Japanese Firms, *Chapter 5*: Extensions of the Multiple *q* Model: (I) Heterogeneity by Enterprise Size, *Chapter 6*: Extensions of the Multiple *q* Model: (II) Heterogeneity by Mode of Acquisition, and *Chapter 7*: Heterogeneity of Capital: Concluding Remarks.

On Chapter 1: The authors review the development of capital investment research over the past few decades from theoretical and empirical viewpoints. They underline its development in Japan, but also go beyond of Japan. Their initial position is that Tobin's q theory has not yet fulfilled all the expectations in terms of empirical investigations. To overcome this issue, many theoretical models, accompanied by new empirical findings, have been proposed. Research done and represented here assumes that all capital goods are homogeneous and can be aggregated to one single capital good. The authors underline the heterogeneity of capital goods and the nonlinearity of adjustment costs in investment.

On Chapter 2: Here the authors extend the q theory of investment from a single capital good to a setting with multiple categories of capital goods, each with its own cost of investment adjustment. Under a set of assumptions which includes linear marginal adjustment costs, the Multiple q model establishes an relationship between the investment rate of each capital good and the total q. This is equivalent to the standard single q evaluated in the stock market. The authors also give a review about the empirical investigation on the Multiple q model.

On Chapter 3: The authors examine their data, namely: (a) data from established datasets, and (b) data to be constructed from raw data using additional assumptions. Missing data are those on disinvestment of capital stock through sales and retirements, strongly affecting the evolution of capital stock. In 3 ways, they construct disinvestment data for all categories of capital goods. They analyze the summary statistics of the constructed data and related statistics in preparation of the later full-fledged empirical studies.

On Chapter 4: Here, a clarification of the sample period and the summary statistics of the 3 constructed capital stock data sets are made by the authors. By estimating investment functions, they verify the effectiveness of the Multiple q model. Therefore they apply the least-squares method and the instrumental-variables methods. If fact, the authors focus on Generalized Method of Moments (GMM). Then they expand the Multiple q model to a nonlinear investment function by allowing fixed costs of investment adjustment to be non-convex. Eventually they estimate the nonlinear investment function, interpret their implications and offer final notes.

On Chapter 5: Here the authors extend the Multiple q model to data of individual firms. By those the range between small and medium-sized companies but also large ones is covered. Therefore, the authors subdivide capital goods into land and other fixed assets which are tangible. Indeed, according to their empirical estimation results (with sample period 2004–2013), regardless of the enterprise size, land should be treated as an independent capital good incurring unique costs of adjustment. But some variables like debt ratio and tangibility, that were found to be redundant in standard Tobin's *q* theory, were now understood to have a powerful explanatory significance, whereas some behaviors lumpy investment exist which cannot be handled by a smooth investment adjustment function of cost. For smaller firms the "lumpiness" of investment behaviors is higher, which suggests that imperfections in the capital market sometimes constrain lumpy investments.

On Chapter 6: The authors evaluate the heterogeneity of capital stock and investment behavior. They mutually match 4 categories of capital goods (buildings and structures; machinery and equipment, vessels and vehicles; and land) and 3 modes of acquisition (new construction; second-hand acquisitions; and large-scale repairs) using domestic micro data. Based on the data on investment rates, they perform analyses using 2 approaches: (i) an estimation using the Multiple q investment function with a convex adjustment *cost* function, according to Tobin's q theory, and (ii) a factor analysis allowing for a *non-convex* adjustment-cost function. They observe that the factor loading turns out to be similar in segments with common acquisition modes. Furthermore, the assessed parameters for the costs of investment adjustment are more affected by the acquisition mode than by the type of capital good. Thus, the investment behavior around the new construction can partially be explained by the convex adjustment cost function. But the existence of a non-convex adjustment cost function is suggested as well for second-hand acquisition and large-scale repair modes. Eventually, the new construction relates strongest with the replacement investment ratio.

On Chapter 7: Here the research results obtained by Multiple q model of capital investment are summarizes and discussed. The authors affirm that characteristics and features of capital stocks are heterogeneous with respect to their physical attributes or qualitative classifications. They underline that costs do not necessarily exhibit the linearity and convexity assumptions of standard neoclassical investment theory. Thus, irreversibility and lumpiness of investments can occur. They recall the role of capital market imperfections because of which questioning the Multiple *q* model is not enough to close the gap between theory and practical performance of Tobin's *q* model.

This premium work is well and clearly structured, analytically deep in economics, well exemplified, carefully and statistically documented, and written with taste and foresight.

The authors succeeded to establish the validity of the Multiple q model of investment when differentiating capital goods on the basis of physical attributes and some particular qualitative characteristics. For instance, along the estimated parameters of the investment adjustment-cost functions, Multiple q theory is able to identify the source of the differences in firm's total factor productivity and differences in respective equity prices. Research remains to be done on the gap between theory and practice of Tobin's q theory. By further exploring and advancing research with Multiple q model in neighboring fields will deepen and widen the understanding of investment behavior by managers of firms and by decision makers in economy and politics.

In forthcoming years, improvements and extensions of theoretical foundations and numerical and simulation methods could be considered by the authors and the further academic and applied community, as being initiated and guided by this work. Such a progress may be achieved in the form of further articles and monographs, and in *OR*-terms of regression and classification, dynamical systems, singularity and Morse theory, applied probability and stochastic calculus, semi-infinite and robust optimization, optimal and stochastic optimal control. They may also benefit from our newest *OR*-supported research achievements by collaborative and stochastic games and dynamics, hybrid elements such as thresholds, Boolean networks, regime switching processes and hybrid systems.

Those future advancements could nurture and support successes in management, economics and finance, in the natural sciences and high-technology, in neuro-science and medical sciences, in environmental, geo-, earth-, space- and space-time sciences with their new projects and start-up firms. Certainly most important advances made and contributions given by this book will come from its impulses in initiating and monitoring new companies and markets, and advancing economies in emerging nations and developing countries.

Reference:

Tobin, J., A general equilibrium approach to monetary theory. Journal of Money, Credit, and Banking, 1 (1969) 15–29.