

Lecture Notes in Business Information Processing

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Decision Support Systems IX

Main Developments and Future Trends

5th International Conference on Decision
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Proceedings

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EURO Working Group on Decision Support Systems

The EWG-DSS is a Euro Working Group on Decision Support Systems within EURO, the Association of the European Operational Research Societies. The main purpose of the EWG-DSS is to establish a platform for encouraging state-of-the-art high-quality research and collaboration work within the DSS community. Other aims of the EWG-DSS are to:

- Encourage the exchange of information among practitioners, end-users, and researchers in the area of decision systems
- Enforce the networking among the DSS communities available and facilitate activities that are essential for the start up of international cooperation research and projects
- Facilitate the creation of professional, academic, and industrial opportunities for its members
- Favor the development of innovative models, methods, and tools in the field of decision support and related areas
- Actively promote the interest on decision systems in the scientific community by organizing dedicated workshops, seminars, mini-conferences, and conference, as well as editing special and contributed issues in relevant scientific journals

The EWG-DSS was founded with 24 members, during the EURO Summer Institute on DSS that took place at Madeira, Portugal, in May 1989, organized by two well-known academics of the OR community: Jean-Pierre Brans and José Paixão. The EWG-DSS group has substantially grown along the years. Currently, we have over 350 registered members from around the world.

Through the years, much collaboration among the group members has generated valuable contributions to the DSS field, which resulted in many journal publications. Since its creation, the EWG-DSS has held annual meetings in various European countries, and has taken active part in the EURO Conferences on decision-making-related subjects. Starting from 2015, the EWG-DSS established its own annual conferences, namely, the International Conference on Decision Support System Technology (ICDSST).

The current EWG-DSS Coordination Board comprises of seven experienced scholars and practitioners in the DSS field: Pascale Zaraté (France), Fátima Dargam (Austria), Shaofeng Liu (UK), Boris Delibašić (Serbia), Isabelle Linden (Belgium), Jason Papathanasiou (Greece) and Pavlos Delias (Greece).

Preface

The proceedings of the ninth edition of the EWG-DSS Decision Support Systems published in the LNBIP series present a selection of reviewed and revised full papers from the EURO Mini Conference and 5th International Conference on Decision Support System Technology (EmC-ICDSST 2019) held in Madeira, Portugal, during May 27–29, 2019, with the main theme: “Decision Support Systems: Main Developments and Future Trends.” This event was jointly organized by the EURO Association of European Operational Research Societies and the EURO Working Group on Decision Support Systems (EWG-DSS) and it was hosted by the University of Madeira (UMA) in Funchal, Portugal.

The EWG-DSS series of the International Conference on Decision Support System Technology (ICDSST), starting with ICDSST 2015, was planned to consolidate the tradition of annual events organized by the EWG-DSS in offering a platform for European and international DSS communities, comprising the academic and industrial sectors, to present state-of-the-art DSS research and developments, to discuss current challenges that surround decision-making processes, to exchange ideas about realistic and innovative solutions, and to co-develop potential business opportunities. This year ICDSST 2019 was organized as EURO Mini-Conference (EmC-ICDSST 2019) and had the theme of “DSS: Main Developments and Future Trends” in order to take the opportunity of the celebration of the “EWG-DSS 30th Anniversary” for the conference to evaluate how the research area in DSS has substantially advanced within the past 30 years and how the EWG-DSS has helped the DSS communities to consolidate research and development in the co-related areas, considering its research initiatives and activities.

EmC-ICDSST 2019 recapitulated the developments of the decision support systems area in the past 30 years, enforcing the trends and new technologies in use, so that a consensus about the appropriate steps to be taken in future DSS research work can be established.

The scientific topic areas of EmC-ICDSST 2019 included:

- Advances in research on decision-making and related areas
- Artificial intelligence applied to decision support systems
- Advances in applied decision support systems
- Trends for new developments in decision support systems
- Decision making integrated solutions within open data platforms
- Knowledge management and resource discovery for decision-making
- Decision-making methods, technologies, and real-industry applications
- Geographic information systems and decision-making/support
- Decision-making, knowledge management, and business intelligence
- DSS for business sustainability, innovation, and entrepreneurship
- Decision-making in high and medium education
- Innovative decision-making approaches/methods and technologies

- Big data analytics approaches for solving decision-making issues
- Big data visualization to support decision analysis and decision-making
- Social-networks analysis for decision-making
- Group and collaborative decision-making
- Multi-attribute and multi-criteria decision-making
- Approaches and advances in group decision and negotiation DSS
- Decision support systems and decision-making in the health sector

The aforementioned topics reflect some of the essential topics of decision support systems, and they represent several topics of the research interests of the group members. This rich variety of themes, advertised not only to the (more than 300) members of the group, but to a broader audience as well, allowed us to gather several contributions regarding the implementation of decision support processes, methods, and technologies in a large variety of domains. Hence, this EWG-DSS LNBIP Springer edition has considered contributions of a “full-paper” format, selected through a single-blind paper reviewing process. In particular, at least three reviewers – members of the Program Committee – reviewed each submission through a rigorous two-staged process. Finally, we selected 11 out of 59 submissions, corresponding to a 19% rate, to be included in this 9th EWG-DSS Springer LNBIP edition.

We proudly present the selected contributions, organized in three sections:

1. *Decision Support Systems in Societal Issues:* Cases where decision support can have an impact on society are presented through real-world situations. First, Maria Drakaki, Hacer Güner Gören, and Panagiotis Tzionas use data obtained from management reports for refugees and migrant sites to forecast emotions and potential tensions in local communities. Ana Paula Henriques de Gusmão, Rafaella Maria Aragão Pereira, and Maisa Silva collected georeferenced data from the platform Onde Fui Roubado and the location of the military units of Recife to determine efficient spatial distributions for the police units. Floating taxi data are fed into advanced spatiotemporal dynamic identification techniques to gain a deep understanding of complex relations among urban road paths in the work of Glykeria Myrovali, Theodoros Karakasidis, Avraam Charakopoulos, Panagiotis Tzenos, Maria Morfoulaki, and Georgia Aifadopoulou. This section closes with the work of Guoqing Zhao, Shaofeng Liu, Huilan Chen, Carmen Lopez, Lynne Butel, Jorge Hernandez, Cécile Guyon, Rina Iannacone, Nicola Calabrese, Hervé Panetto, Janusz Kacprzyk, and Mme Alemany on the identification of the causes of food waste generation and of food waste prevention strategies, a critical symptom of modern societies.
2. *Decision Support Systems in Industrial and Business Applications:* Approaches that illustrate the value of decision support in a business context are presented. Herwig Zeiner, Wolfgang Weiss, Roland Unterberger, Dietmar Maurer, and Robert Jöbstl explain how time-aware knowledge graphs can enable us to do time series analysis, discover temporal dependencies between events, and implement time-sensitive applications. George Tsakalidis, Kostas Vergidis, Pavlos Delias, and Maro Vlachopoulou present their approach on how to systematize business processes through a conceptual entity applicable to BPM practices and compliance-checking via a contextual business process structure that sets the boundaries of business

process as a clearly defined entity. This section finishes with the work of Pascale Zaraté, Mme Alemany, Mariana Del Pino, Ana Estesó Alavarez, and Guy Camilleri, who use a group decision support system to help farmers in fixing the price of their production considering several parameters such as harvesting, seeds, ground, season, etc.

3. *Advances in Decision Support Systems Methods and Technologies*: This section highlights methods, techniques, approaches, and technologies that advance the research of the DSS field. Sarra Bouzayane and Inès Saad use a supervised learning technique that allows one to extract the preferences of decision-makers for the action categorization for an incremental periodic prediction problem. Georgios Tsaples, Jason Papathanasiou, Andreas C. Georgiou, and Nikolaos Samaras use a two-stage data envelopment analysis to calculate a sustainability index for 28 European countries. Alejandro Fernandez, Gabriela Bosetti, Sergio Firmenich, and Pascale Zarate present a technology that brings multiple-criteria decision support on Web pages that customers typically visit to make buying decisions. Advances in decision support continue with the work of Oussama Raboun, Eric Chojnacki, and Alexis Tsoukias, who focus on the rating problem and approach it with a novel technique based on an evolving set of profiles characterizing the predefined ordered classes.

We would like to thank all the people who contributed to the production process of this LNBIP book. First of all, we would like to thank Springer for continuously providing EWG-DSS with the opportunity to guest edit the DSS book. We particularly wish to express our sincere gratitude to Ralf Gerstner and Christine Reiss, for their dedication in guiding us during the editing process. Secondly, we thank all the authors for submitting their state-of-the-art work for consideration to this volume, which marks an anniversary of 30 years of the EWG-DSS and confirms to all of us that the DSS community continues to be as active as ever with a great potential for contributions. This encourages and stimulates us to continue the series of International Conferences on DSS Technology. Finally, we express our deep gratitude to all reviewers, members of the Program Committee, who assisted on a volunteer basis in the improvement and the selection of the papers, under the given competitive scenario of the papers and the tight schedule. We believe that the current EWG-DSS Springer LNBIP volume brings together a rigorous selection of high-quality papers addressing various points of decision support systems developments and trends, within the conference theme. We sincerely hope that the readers enjoy the publication!

March 2019

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