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Outlooks and Insights on Group Decision and Negotiation

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Preface

Group decision and negotiation (GDN) refers to the academic and professional discipline that focuses on gaining an understanding of collective decision-making processes. It is involved with the formulation of rules, models, and procedures to improve these processes. The range of GDN research reflects the breath of the strategic and tactical, social–psychological and economic, individual and group, conflict and cooperation, and software-supported and software-conducted processes. The field encompasses theory building and testing, laboratory and online experiments, as well as observations in the field. Therefore, GDN researchers are involved in the theoretical, experimental, and applied studies as well as in the development, testing, and implementation of support systems, decision aids, and software agents. They aim at helping decision makers, advisors, facilitators, and third parties to deal with difficult problems, make better decisions, and/or delegate certain decisions to software.

GDN meetings bring together researchers and practitioners from the fields of humanities, social sciences, economics, law, management, engineering, and computer science. These diverse areas reflect the breath of GDN research. The meetings' participants discuss and compare different paradigms, methods of inquiry, and objectives that they employ in their research. What is common to all participants is their interest in the difficult decision problems that involve conflicts and/or cooperation and the challenges that people face when they attempt to find satisficing agreements and to reach consensuses.

Researchers from the Americas, Asia, Europe, Africa, and Oceania participate in GDN meetings. They have a stimulating variety of backgrounds and represent a wide range of disciplines. While many of us come from different traditions, we all share a common passion: research into complex decision making and negotiation involving multiple stakeholders, different perspectives, issues, and emotions, requiring decision and negotiation support for both process and content.

The Group Decision and Negotiation (GDN) conference series started in Glasgow, Scotland, UK, in 2000 and was hosted by Colin Eden. At that time, Mel Shakun—the founding member of the section and its chairperson from 1995 until 2014—assumed that the next conference would take place only after several years. There was so much interest, however, that the second meeting took place just one year later. It was organized by Alain Checroun and held in La Rochelle in 2001. Mohammed Quaddus organized the next meeting in Perth (2002). Then, from Western Australia we moved to Istanbul (2003) and the following year to Banff (2004); these latter two meetings were held as a meeting-within-a-meeting at larger INFORMS-affiliated conferences.

The memorable GDN meetings that took place in Vienna and Karlsruhe were hosted by Rudolf Vetschera (2005) and Christof Weinhardt (2006), respectively. The 2007 GDN meeting was organized by Gregory Kersten at Mont Tremblant in Quebec, Canada. João Climaco and João Paulo Costa hosted GDN 2008 in Coimbra. Then, Gwendolyn Kolfschoten organized GDN 2010 in Delft.

Amer Obeidi did a lot of work on the organization of GDN 2011 in Amman, Jordan. Unfortunately, this meeting did not take place because of the events in neighboring countries at that time. The next year, Adiel Teixeira de Almeida organized GDN 2012 in Recife, Pernambuco, Brazil. GDN 2013 was hosted by Bilyana Martinovski in Stockholm and it was followed by the GDN 2014 meeting in Toulouse, which was hosted by Pascale Zarate.

GDN 2015 was the 15th meeting organized by the INFORMS section on Group Decision and Negotiation. The conference was hosted by Tomasz Szapiro at the Warsaw School of Economics in Warsaw. During this meeting we revived the Young Researcher Award that was first given at the 2007 meeting. The award was given to a student researcher who authored and presented the best paper at the conference. In addition to this award, young researchers also participated in the Doctoral Consortium. Ofir Turel and Rudolf Vetschera served as the consortium's chairs and hereby we acknowledge their contribution.

At the 2014 GDN meeting two volumes of proceedings were introduced; one volume published by Springer in the LNBIP series [1] and the second volume published by Toulouse University [2]. The GDN 2015 proceedings are also in two volumes: the present volume and the accompanying volume [3].

In both volumes we have introduced thematic streams of sessions. Researchers who participated in the organization of the streams wrote introductions to each stream. These introductions are included in the separate section "Introductions" (pp. XIII–XLVI). They briefly discuss the streams' contributions published in both volumes thus making them better integrated. We hope that this will give the readers a more comprehensive overview of all contributions.

The contributions in this volume and in the proceedings [3] reflect the richness of GDN scholarship. Using a variety of research approaches including real organizational settings and laboratory situations, they focus on the development, application, and evaluation of concepts, theories, methods, and techniques.

The contemporary political landscape abounds in situations of multidimensional conflicts which mix military, economic, and social dimensions. Troops and tanks, economic measures and sanctions, as well as massive violent protests may become destructive means of conflict resolution. Wisdom armed with values, knowledge, and methods will assist politicians in the creation of new instruments for effective group decisions and negotiations. These widely shared expectations challenge researchers and simultaneously direct their efforts in creation and dissemination of ethically driven, knowledge-based applicable findings. The multicultural and interdisciplinary GDN community presents their results on progress in this area.

"Collaboration leads to growth, which engenders accomplishment." [2, p. VIII]. The GDN 2015 conference and its proceedings were made possible through the collaboration of many researchers, students, and support staff. Their dedication and support were exceptional. We are grateful to all of them; to those who made contributions, presented papers, prepared the proceedings, maintained the conference website, and undertook many other necessary tasks. Their contributions, including help in the

organization of the streams and the sessions as well as the accompanying events, were key to the success of this meeting. We thank the reviewers for their work. It is thanks to their in-depth reviews that we are able to maintain the high academic standard of the GDN meetings. The stream organizers' and reviewers' work is greatly appreciated, particularly because often they were given very little time. Their reviews provided the authors with much-needed feedback. Thank you:

Fran Ackerman, Yasir Aljefri, Adiel Almeida, Marek Antosiewicz, Reyhan Aydogan, Deepinder Bajwa, Martin Bichler, Réal Carbonneau, Wojciech Cellary, João Clímaco, Grazia Concilio, Ana Paula Costa, Suzana Daher, Luis Dias, Colin Eden, Verena Dorner, Liping Fang, Mario Fedrizzi, Michael Filzmoser, Florian Hawlitschek, Shawei He, Keith Hipel, Masahide Horita, Michał Jakubczyk, Marc Kilgour, Mark Klein, Grzegorz Koloch, Beata Koń, Sabine Koszegi, Kevin Li, Jan Machowski, Yasser Matbouli, Paul Meerts, Danielle Morais, José Maria Moreno-Jiménez, Hannu Nurmi, Amer Obeidi, Pierpaolo Pontrandolfo, Ewa Roszkowska, Anne Rutkowski, Mareike Schoop, Roman Słowiński, Rangaraja Sundraraj, Przemysław Szufel, David Tegarden, Timm Teubner, Ernest Thiessen, Sathyanarayanan Venkatraman, Rudolf Vetschera, Doug Vogel, Tomasz Wachowicz, Christof Weinhardt, Dariusz Witkowski, Paweł Wojtkiewicz, Shi Kui Wu, Yinping Yang, Bo Yu, Yufei Yuan, Pascale Zaraté, Mateusz Zawisza, John Zeleznikow, and Daniel Zeng.

The quality of the presentations is associated with the excellence of the papers. It is also affected by the venue and the overall organization of the meeting and its associated events. The local Organizing Committee was responsible for these aspects of the meeting and they did everything to make the meeting pleasant and memorable. Thank you:

Przemyslaw Szufel, Marek Antosiewicz, Michał Jakubczyk, Grzegorz Koloch, Beata Koń, Tomasz Kuszewski, Jan Machowski, Paweł Wojtkiewicz, and Karolina Zakrzewska-Szlichtyng.

Finally, we thank Michel J. Shaw, an editor of the LNBIP series, who helped us to get the GDN proceedings into the series, and Ralf Gerstner, an executive editor at Springer, who guided us through preparation and submission of the proceedings.

We hope that you find the contents of this book as well as the contents of the accompanying volume [3] useful and interesting. The authors' effort in clarifying complex problems and proposing innovative solutions should help you to cope with numerous challenges that are faced by researchers of group decision and negotiations. We also hope that the meeting and the contributions foster collaboration among the meeting's attendees as well as joint projects with researchers who were not able to come to Warsaw and participate in GDN 2015.

April 2015   Bogumił Kamiński
                                                           Gregory E. Kersten
                                                           Melvin F. Shakun
                                                           Tomasz Szapiro

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GDN | 2015

GROUP DECISION AND NEGOTIATION

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Introductions

The Conference Streams and the Proceeding Sections

The papers submitted to GDN 2015 were organized somewhat differently than in past years. There were nine streams at the conference with each stream constituting one section of the Springer 218 LNBIP Proceedings as well as one section of the accompanying Proceedings published by the Warsaw School of Economics.

The multidisciplinary aspect of research on group decision and negotiation processes poses challenges for organizers. These include, but are not limited to: extending invitations to renowned researchers to deliver invited lectures; approaching colleagues to review submissions; and maintaining an overview of the process.

Our colleagues who generously agreed to be the Streams Organizers succeeded in attracting many renowned scholars to the conference. They facilitated the assessment of submissions and reviewed many papers. They also wrote introductions for each stream providing unique insights into the current directions and findings in group decision and negotiations. All of this work was done under time pressure as the deadlines for preparing the proceedings were very tight.

Each of the two volumes of the GDN 2015 proceedings has nine sections. Correspondingly, you will find here nine introductions. We wish to express our gratitude to the Stream Organizers as well as the authors of the introductions. Our thanks go to:

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Verena Dorner, Timm Teubner, and Christof Weinhardt.

Bogumił Kamiński and Gregory E. Kersten
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Group Problem Structuring and Negotiation

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1 Overview

Welcome to the stream focusing on group problem structuring and negotiation. We are delighted to have received so many interesting papers reflecting the vibrancy and relevance of the area. All of the papers focus, to some extent, on the behaviours within small groups: small group problem solving and decision making, managing conflict and multiple perspectives, and developing competences.

There are important emerging themes showing the research effort in this area takes a number of different but also related directions:

– Taking a 'human' approach to the topic rather than focusing only on an analytical approach to negotiation. Consequently many of the papers discuss work with groups recognising the need to attend to the socio-political aspects as well as supporting decision making. This is evident in papers where we see research being carried out which (a) explores and supports the negotiation between multiple collaborators who may also be competitors; (b) aims to support the management of conflict, (c) recognises the importance of considering procedural justice authentically, and (d) seeks to enhance the negotiation abilities of staff within organizations [1–5].
– Exploring new angles relating to problem structuring through (a) use of group support systems adopting causal modelling and facilitation to ensure procedural justice is fully supported and views can be widely contributed, (b) the interaction between consultant and client where the use of productive dialogue can aid the development of an effective relationship and affect the trajectory and outcomes of the workshops and (c) unpacking complexity associated with the practice of problem structuring [4–5, 7–8].
– Focussing on application with papers discussing work in the area of disaster management planning involving community groups, in strategy making in relation to the use of artefacts to support effective sense-making, in supporting etc., in health care planning of an aging population where group support systems are used to ensure a more effective use of data, in encouraging organizations to view negotiation as a corporate competence, with UK clinical strategy making groups helping to improve outcomes, and in social housing in relation to the assessment of which housing projects to fund to meet the technical and social conditions [1, 8, 9–10].

Notably the papers reflect work being done in different locations: UK, Italy, Sweden, Australia, China; and within different types of organization from public sector (health and housing) to private sector (conflict management, competence development).

We hope that you will find the themes of interest and consequently join us at the conference.

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Negotiation and Group Processes Support

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1 Overview

Negotiation and group processes are complex interactions among the parties conducted in an effort to arrive at a decision that they accept and are willing to implement. These interactions are based on communication, both verbal and nonverbal, that aims at educating the participants about ones needs, preferences, and limitations. The communication is framed by the negotiation strategies and tactics, including promises, assurances, and threats. In addition, third parties and other stakeholders as well as a broader context and external events, are likely to affect the discourse between the parties.

Negotiation and group processes are decision making processes that require that the participants assess the alternatives and evaluate offers made by other participants. Often, the participants need to make concession while searching for potential improvements of the negotiation results. These processes exhibit both socio-psychological, economic, and decision-analytic aspects making them difficult to organize and manage.

Both behavioural and formal approaches to negotiations and group decisions resulted in numerous studies. Behavioural approaches use methodologies and test models formulated in anthropology, psychology, sociology, communication, and organization science. They often focus on such aspects of negotiation and group processes as the context, the stages of the process of conflict solving, the relationship between parties, the parties' reputation, behaviour, strategies and tactics. They examine the influences of the participants' personal, demographic, cultural, or professional traits on their actions and the outcomes. Some studies aim to build theories and to formulate procedures for effective management of conflicts and for the construction of checklists that are to help the parties organize their tasks.

Formal approaches have been developed within the fields of economics, management science, decisions science, game theory, and econometrics. They assume that the participants are rational or at least logical decision-makers with a value-seeking perspective on the process. They rely on formal models of the processes and develop methods for aiding and supporting decision-making in both individual and collaborative settings. These models can be used to facilitate the analysis of the problem and the participants prior to their interactions. They also can be used during the process, in order to analyze one's own and the counterparts' decisions and to provide alternative courses of action.

Many formal methods rely on the game-theoretical concepts and formulate normative recommendations for negotiators who are efficient and rational. They suggest solutions that allow the negotiators to achieve optimal outcomes. They also provide the tools for formal statistical analysis of the experimental results.

Studies that aim at presenting a more comprehensive view include both approaches. This includes research which aims at experimental or in the field verification of formal procedures for conflict management and resolution as well as formal models embedded in software. The approaches rely on computer science, management information systems and software engineering to provide development tools and platforms for the design and construction of group support systems, negotiation and e-negotiation systems, online mediators, decision aids, and negotiation software agents.

The papers mentioned below are included in this proceedings (Section 3) and in the accompanying proceedings published by the Warsaw School of Economics [1]. Their authors study the problems of how the negotiation and group process and the results can be influenced by:

– negotiation strategies and tactics which the parties employ;
– negotiators' personal and demographic characteristics and external factors; and
– the facilitation procedures, models and frameworks applied to support the negotiators' activities.

2 Negotiation Strategies and Tactics

The difficulty in defining an effective negotiation strategy that best fits the negotiation problem and context and results in most profitable outcomes is one of the most important tasks in the pre-negotiation preparation. Such a strategy determines not only the general behaviour and tactics used by the parties, but also specific moves such as opening offers, response rules, concession paths etc. In [2] the effects of using the door-in-the-face tactic is studied. The authors prove that it leads to feelings of mistreatment by the opponents, who, however, may use such an approach in future negotiation to make larger demands and achieve better outcomes. The relationship between purchasing managers' negotiation styles and tactics is examined in [3]. The authors confirm that the long-term orientation of purchasing negotiators had an impact on their applied negotiation tactics.

The following two papers analyze the effect of frames and anchors in the negotiation process. In [4] the use of language to frame the negotiation as integrative or distributive while holding the offers and payoffs constant was studied. The second paper is focused on analyzing the importance and effects of first concessions made by parties [5], being the anchors in the negotiation process. It appears that the party who submitted the first concession achieved a better individual outcome and, furthermore, that the first concession influenced the opponent's concession behavior in terms of the reward theory.

3 Personal Characteristics and External Factors

The second group of papers is focused on analyzing various factors that may influence the negotiation and group process or the participants' behavior and outcome. The influence of demographic factors, process measures, and individual and joint outcomes on the desire of the participants to negotiate again with their counterparts is studied in [6]. The interesting finding is, that post-negotiation perceptions of honesty and individual outcome had differential effects on the desire to negotiate again, depending on whether or not an agreement was reached.

The main personal traits are also studied in [7], but from the viewpoint of hindering the facilitation of cooperative negotiations in familial disputes.

The participants' creativity and their cognitive limitations, such as a need for closure, are identified in [8]; their impact on negotiation outcome is studied by using a Dynamical Negotiation Networks model.

An important issue of negotiation data collection and its relevance in negotiation research is studied in [9]. The transcribed video recordings of negotiations are compared with the negotiators' statements included in post-surveys in order to determine the negotiators' recall of their performance and to find how well they remember their negotiation.

4 Frameworks, Models, and Procedures

From the viewpoint of effective management of the negotiation and group processes as well as for the purpose of their support it is highly important to develop models, procedures and frameworks. The process formal representations can be implemented in software and provide prescriptive or normative recommendations.

Modelling may be done at the choice and decision-level as well as at the meta-choice level. The issue of a procedural meta-choice problem is discussed in [10]. Such problem may appear if a group of decision-makers cannot agree on a decision rule. The authors propose a relation-valued procedural choice rule and discuss the advantages and limitations of such a rule.

The complexities faced by the intergovernmental organizations (IGO) during post-conflict reconstruction are studied in [11]. This paper discusses the added-value of social responsibility in the context of a "comprehensive approach," to better grasp the organizational design of the latter.

The processes that involve intergovernmental organizations are also discussed in [12]. The paper addresses the effects of the International Criminal Court (ICC) interventions on negotiated peace processes. The paper offers an analytical framework which aims at the identification and assessment of the effects of the ICC on conflict and peace processes.

A conceptual model on the role and impact of cultural intelligence on conflict and its management and on negotiation behaviors in culturally diverse environments is presented in [13]. A general process model focuses on the goal-oriented balancing process. It describes the necessity for negotiators to continuously balance the opposing

forces in order to reach the goal. It is an interactive model that tries to incorporate all the important dimensions that exist in negotiation processes.

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Preference Analysis and Decision Support

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1 Overview

The outcomes the parties achieve in group decision and negotiation and the efficiency of the results they obtain are of major importance for economics and management science. To measure the quality of the negotiation agreements or the decisions made by the groups, the preferences of all parties involved in the bargaining process need to be elicited first. This requires that the negotiation problem is represented formally and the negotiation template is designed and evaluated. Based on the evaluation a scoring system can be built and used to evaluate the negotiation offers and alternatives for the agreement. Such a system allows to support the parties to analyze the negotiation progress, measure the scale of concessions made by the parties; and to visualize the negotiation history and the negotiation dance. It also allows to conduct the proactive mediation and/or arbitration and to search for a fair solution for all the parties involved.

Various formal methods, techniques and models may be used to support decision-makers to define their goals, elicit preferences and construct scoring systems. These methods are derived from the fields of multiple criteria decision-making (MCDM) and game theory. These methods, however, need to be modified and adopted to fit the decision context that is characteristic to negotiations and group decision-making, e.g. deciding under the pressure of time, and/or when the negotiation space is imprecisely defined, reservation and aspiration levels are changeable and many decision makers are involved. Moreover, the negotiators' cognitive and perceptional capabilities as well as their formal knowledge and skills for using different mechanisms and tools (for negotiation support) need to be taken into account in redesigning the existing and designing new methods and algorithms for preference elicitation and decision support in negotiation and group decision making. This often requires that new the software solutions such as the negotiation and group decision support systems be built.

The main contribution of this section is bringing together the perspectives of researchers and practitioners (in the field of group decision and negotiation analysis) on recent developments and findings in the areas of preference analysis and decision support. We have contributions on both theoretical and empirical aspects of designing

and using formal models and techniques for preference analysis and decision support in negotiation and group decision making.

The papers included in this section and in the accompanying volume [1] are divided into the following four groups:

1. Methodological issues of preference analysis.
2. Application of MCDM methods in negotiation and group decision support.
3. Applications in real-world negotiations and group decision making problems.
4. Group decisions based on partial information or imprecise and vague preference.

2 Methodological Issues of Preference Analysis

The quality of results obtained in group decision processes depends on the foundations of preference analysis, so methodological issues play an important role in the area. The understanding and the use of group decision analysis model is of particular relevance. The concepts and intuitive logic for the group decision model is approached in [2], including some practical aspects of applying it. One of the issues is related to preference strength, which is considered in [3]. Surrogate weights are associated with the fact that decision-makers often possess more information regarding the relative strengths of the criteria to be incorporated in the preference analysis process.

Group preference management in social choice and in the recommended systems is considered in [4], which presents a comparative study of preference management. There are also two papers which discuss the problem of the effective usage of SAW in order to construct a negotiation offer scoring system. The issue of inaccuracy in defining preferences by the electronic negotiation system users is studied in [5]. The authors consider the elicitation of the negotiators' preferences with a simple additive weighting method. The linkages between the scale of inaccuracy and the negotiation profiles are verified [6]. The methodological differences between two alternative methods are discussed in the last paper in this grouping [7]. The authors compare MARS and GRIP from the perspective of the holistic evaluation of the negotiation template.

3 MCDM Methods

This group of articles deals with MCDM methods and their application to the negotiation and group decision contexts. An MCDM model is used to compare subjective and objective evaluation in [8], including an application to analyze the graduate's leaning ability. A well know MCDM method, ELECTRE III is considered for a group decision-making in [9], in which inference of pseudo criteria parameters are worked out. The dominance-based rough set approach is considered in [10] for an MCDM group decision model for supporting operations in intelligent electrical power grids. Using an additive weighting method is considered in [11] as a part of an algorithm for evaluation of the stakeholders in the sustainability reporting process. Finally, the issue of universal judgments in human groups and communities concerning

procedural fairness and just outcomes is discussed in [12], aiming to legitimize group decisions and outcomes and to generate group equilibria.

4 Empirical Applications

Papers in this section deal with applications of formal decision support tools to facilitate real-world negotiation and group decision making problems.

A procedure for finding compromises among the watershed communities is proposed in [13]. The algorithm described by the authors applies ELECTRE II for supporting individual choices and then aggregates them through a weighted voting system based on classification by quartile. The idea of a new model for subcontractor selection applying different support algorithms for high and low costs of hiring contracts is presented in [14].

5 Partial Information and Imprecise Preference

There are situation in which preferences cannot be precisely defined. The papers in this section deal with such situations in the group-decision making context. An approach hybridizing the notion of veto and adjusting function incorporated into the additive model, and trapezoidal fuzzy numbers to solve group decision making problems is proposed in [15]. A different approach, one that stems from linguistic fuzzy rough sets, is presented in [16]. The model is enriched by introducing the linguistic hedges with the inclusive interpretation.

The notion of hesitant fuzzy sets is applied to TOPSIS algorithm [17]. The authors recommend that the algorithm be used to determine the weights of criteria in group decision-making problems. Fuzzy environment is also considered in [18], where classic PROMETHEE is adopted for the problem of selecting a facility location.

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Formal Models

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1 Introduction

Decisions made by collectives constitute a major issue in our civilization. Nowadays, global governance is crucial, mainly because of economic, environmental and social challenges, such as the food shortages, the increasing inequalities worldwide, the environmental and climate changes, and security problems. Broadly speaking, the following quote characterizes the present situation: "if we accept the point that we are living in the time of changing civilization eras, and conceptual change is one of the main ingredients of the civilization change, up to the formation of a new episteme, then the need of new concepts and approaches, even new hermeneutical horizons also within group decisions and negotiation theory is evident" [1].

In these circumstances it is crucial to re-invent the global governance which implies a parallel revolution in the framework of collective decision procedures at the local and global levels. Of course, the new communication technologies, and in particular the Internet, open bright horizons enabling the interactive combination of human intervention aided by computerized decision aids. However, it must be emphasized that the analysis and support of group decisions as well as of negotiation processes are complex, multi-disciplinary tasks involving psychological, sociological, cognitive and political issues. Therefore, the real improvement of group decision and negotiation on a global scale is a major challenge in the XXI century.

Mathematically based models have been developed in the framework of operations research, systems science, game theory, etc., and they are an essential part of many group decision and negotiation support systems.

2 Framework

Kilgour and Eden in the introduction to the Handbook on GDN [2] note that:

> "The use of formal procedures for reaching a collective decision-making can be 'improved' by a systematic approach or by a kind of group support. Group decision and negotiation is the academic and professional field that aims to understand, develop, and implement these ideas in order to improve collective decision processes."

In order to foresee the potential and the limitations of the use of any mathematical model in this framework it seems that some ideas must be first articulated, namely:

– The range of the field is very broad and studied from very diversified perspectives, including not only a wide type of situations involving collaboration/conflicting,

tactics/strategies, cognitive/emotional, social/cultural issues, but also the cross-fertilization of a large number of disciplinary areas, such as theory of the organizations, political science, sociology, psychology, telecommunications/internet, systems science, operations research, information systems, decision support systems, etc.

– Generally speaking, the developed approaches range from the theoretical analysis of the specific types of problems to the process oriented prescriptive support tools, and also the descriptive approaches. The intended help does not consist of showing the various actors involved in the course to follow, but rather of constructing a set of coherent recommendations that contribute to the clarification of the process. Thus, the models' goals and values do not run the risk of being replaced by any calculated rationale.

– Davey and Olson [3] observe that: "Decision making groups can range from cooperative, with very similar goals and outlooks, to antagonistic, with diametrically opposed objectives. Even in cooperative groups, conflict can arise during the decision process". In order to clarify the meaning of the co-existence of *collaboration* and *conflict* in group decision and in negotiation it is recommended that contrasting characteristics of these concepts be considered [4].

In group decisions we deal mostly with common sets of alternatives and objectives, while in negotiations proposals are sequentially presented by parties, which involves making concessions. This peculiar interdependence among actors, "rather than conflict, distinguishes negotiation from other forms of decision making" [5]. Furthermore, sharing information is characteristic of group decisions, contributing to the reduction of uncertainty and ambiguity; in negotiations information, values and beliefs of the parties are hidden. In group decisions leaving a group is not usual, and, inversely, the group cohesion is promoted. Finally, negotiation involves competition, while group decisions are mostly based in deliberative processes.

3 Mathematically Based Models

3.1 Models and Reality – Are Simplifications Acceptable?

A very old drawback concerning real world applications of operations research is the mistrust in mathematical models, particularly prevalent in group decisions and negotiations where the complexity and the range of scientific, cultural, social and behavioral issues are even more relevant. Rapoport [6] observed that:

> "The mathematical model is a set of assumptions. We know that every assumption is false. Nevertheless we make them, for our purpose at this point is not to make true assertions about human behavior but to investigate consequences of assumptions, as in any simulation or experimental game."

Kersten [7] noted that Rapaport presented a conundrum that is particularly troublesome when the models and systems are used by the end-users, i.e., the decision-makers rather than by the analysts and OR specialists. He commented that:

"The above quote, while controversial, suggests that formal models and support systems in which they are embedded may suffer from false assumptions or from assumptions that either seem unreasonable or are difficult to accept".

He proposed that to overcome this blocking situation an outreach strategy could be used [7]. This new strategy should pursue new hermeneutical horizons [1]. Rather than the continuation of the traditional path a new paradigm is proposed. In the outreach strategy assumptions and simplifications of mathematical models are still necessary, but they should be validated by the actors of the group decision and negotiation process; building systems integrating several complementary approaches is advisable; and those systems cannot forget social and behavioral issues, etc.

In what follows the papers included in this track are discussed.

3.2 Multi-criteria Analysis

In recent years, multi-criteria models integrated in group decision and negotiation systems have undergone major development, and, in our opinion, in many cases, the most adequate are the models rooted in constructivism. The use of multi-criteria models allows us to avoid one of the problems that has followed us over time, the aggregation of the preferences of decision agents in a single criterion, which reduces everything to just one measure. Some multi-criteria approaches propose the combination of algorithmic protocols and the experience and intuition of the actors intervening in the process of preference aggregation. However, if only formalized procedures are used to aggregate preferences of criteria and decision actors, these can be interactive, and oftentimes they should not be compensatory. Furthermore, it must be remarked that aggregation always implies loss of information, therefore it means that it needs to be done carefully and the resulting simplification needs to be assessed.

Different categories of models have been used in the past, i.e. multi-attribute models, including value functions and outranking approaches; and mathematical programming models, highlighting goal programming approaches. As the lack of adequate information is particularly relevant when we integrate multi-criteria models in group decision and negotiation aiding systems, we would like to register/draw the readers' attention to the use of models using incomplete/imprecise information. See, for example, an additive model based system dedicated to using incomplete information regarding the scaling constants and integrated in a GDSS – VIP Analysis [4], and a GDSS – IRIS integrating an aggregation/disaggregation approach for the ELECTRE TRI method [8].

This track includes two papers that present different multi-criteria models.

– A cooperative group multi-attribute analysis of routing models for a telecommunication network is discussed in [9]. The proposed method is grounded in GDSS – VIP Analysis which allows for incomplete information regarding scaling constants. This method is used to support a group of experts in the evaluation of alternative options of decentralized routing models.
– An interactive evolutionary multiple objective optimization model for group decision problems is proposed in [10]. The user interacts with the model via ordinal regression in order to identify the set of Pareto-optimal alternatives. The authors

propose an interactive meta-heuristic approach dedicated to a multiple objective optimization problem where preference information is provided by several decision makers and incorporated into the evolutionary search. The interaction is based on ordinal regression building value functions. In our opinion the added value of this paper is the careful experimentation with several variants of the interactive procedure exploiting conjointly the preference information provided by the decision makers.

3.3 Game Theory

Game theory is dedicated to the choice of optimal behavior of two or more rational players interacting strategically. Costs and benefits of each option for one player depend on the choices of the other players. It is clearly the most rigorous approach to dealing with conflicts. In this context it must be emphasized that this type of mathematically based models are the root of many group decision and negotiation theoretical and methodological approaches–in many cases, the analysis of the stability of outcomes is one of its key issues.

Many researchers have exploited a great number of cooperative and non-cooperative game models– some are considered in the following four papers of the GDN 2015 track. On the one hand game theory is a very important and productive field, but on the other hand it has been misused in many situations. We decided that before summarizing the papers of the track integrating Game Models we will pay attention to its limitations/ weaknesses. The following two quotes depict the problem very astutely:

1. "Unfortunately, game models must usually abstract one or a few specific features from a real world situation, drastically simplifying the rest, in order to avoid problems of complexity and tractability. In most cases, realistic game models are impossible to analyze." [8]
2. "The weaknesses of game-theoretic approaches include the treatment of the process and its impact on the game itself, and strict rationality assumptions which, for numerous reasons, rarely hold (e.g., imperfect information, parties' cognitive limitations, and deception)… Thus, while game-theoretic methods have a significant role to play in the prior or posterior analysis of the group decision or negotiation problems, their usefulness as a support tool during the process is limited". [6]

We believe that the above lines give an accurate picture of the problem. The four papers which rely on game-theoretical models are briefly discussed below.

– A fiscal-monetary non-cooperative game can be studied with the use of a dynamic macroeconomic model [11]. The fiscal and monetary authorities' strategic moves and the Nash equilibrium are analyzed. The simulation of the results enables to conclude that, as in many other situations, that in general the Nash equilibrium is not Pareto optimal. In these circumstances, looking for a Pareto optimal negotiation outcome is necessary. The paper, in general is interesting but of a particular interest are the computer simulations for various states of the economy and the discussion. As the Nash equilibrium is not Pareto optimal, the proposal to promote negotiations based on a bargaining problem which is analyzed using multi-criteria optimization tools is also interesting.

– A stochastic dynamic cooperative game which represents interaction among decision agents who control a dynamic system is discussed in [13]. The agents represent economic and financial entities such as real-estate market and regional economic, and social networks. The authors study the dependence among the characteristics of the trajectory of the aggregate outcomes, the behavior of the decision agents (namely the interaction among decision agent preferences) and the importance of the localization of the decision agents in respect to specific local centers. The usefulness of the proposed game is discussed.

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Voting and Collective Decision-Making

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1 Overview

Voting is an important way to make group decisions. It has been used in a wide variety of contexts ranging from highly regulated and formalized – e.g. political elections – to informal ad hoc settings used in deciding leisure activities in small groups. Often the elections are considered as essential elements of democratic governance.

The specific procedures of voting, however, vary greatly, not only between countries, but also within countries. For instance, one system regulates in the election of the head of state, while another one is followed in electing the members of legislature. Or, one system is used in electing the leaders of religious communities, while another is resorted to in electing the presidents of universities. This variety of procedures has given rise to a rich literature on the desiderata associated with procedures. For example, which precise properties of procedures pertain to democratic group decision making or to collective rationality?

The theory of voting and collective decision making is based on the social choice theory. Its best-known results tend to be of negative nature; they demonstrate incompatibilities among various desirable choice-theoretic properties. Some of the incompatibilities are surprising, counterintuitive or paradoxical. While these results are unquestionably important, it is important to study their relevance in real world collective decision making. The context in which the procedures are being used as well as the plausibility of their underlying assumptions are important determinants of the relevance. Which goals are the procedures intended to serve? To what extent are these reconcilable with the goals of the participants? Are the expected outcomes of procedures likely to be welfare increasing or divisive? These are some of the issues discussed in this stream of presentations.

The papers included in this section as well as the papers included in the accompanying volume [1] can be thematically divided into the following three groups:

1 The direct vs. indirect (representative) aggregation of opinions;
2. Alignments, power and bargaining; and
3. The choice of rule.

2 The Direct vs. Indirect Aggregation of Opinions

Many results in the social choice theory pertain to aggregation of opinions. One of them, the referendum paradox, is the phenomenon whereby the outcome of collective decision making involving just two alternatives (yes-no) crucially depends on the order in which the aggregation takes place. The possibility of this paradox opens new vistas for strategic behavior among participants [2]. Strategic behavior is often viewed as intentional strive for individually beneficial outcomes, but it can also be related to the more permanent personality traits of voters. It is, therefore, worthwhile to study the expected consequences of the prevalence of specific personality traits among voting population [3].

3 Alignments, Power, and Bargaining

Both voting and bargaining are the mechanisms that aim at working out universally acceptable outcomes when the interests of the participants differ. The setting where there are only two participants with different opinions regarding two options already captures the some essential differences and similarities of the two mechanisms [4]. Various procedures have obvious implications for power distribution among participants with varying resources. These have been extensively studied in dichotomous settings. However, with three or more alternatives considered simultaneously, the measurement of a priori voting power becomes more complicated [5].

4 The Choice of Rule

Historically and analytically the choice of the procedure differs from the application of the chosen procedure in determining policy or the composition of the representative body. Are there any general principles one could resort to in designing a voting rule to be applied in business decisions or in informal settings [6]? The existing – relatively rich – literature focuses on dichotomous choices (rule x *versus* rule y) and often assumes voter preferences regarding the outcomes that result from the application of rules. It is, however, also possible to address the problem via the criteria that various procedures satisfy or fail to satisfy [7]. This renders the rule choice an instance of a general MCDM problem and may seem a plausible way of augmenting the current recommendation systems [8].

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Conflict Resolution in Energy and Environmental Management

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1 Overview

The recent development of new technologies that can help analysts understand strategic conflicts and provide strategic support to negotiators has been a great benefit for many decision makers. New theoretical issues are being explored, and at the same time new software systems are making modeling easier and analytical results clearer. Environmental management, including energy projects, is a natural area of application of technologies for the analysis of strategic conflict, and has motivated both theoretical and practical advances. This stream collects contributions highlighting new advances in the Graph Model for Conflict Resolution (GMCR) and other methodologies that have been influenced by issues arising in environmental management, energy development and other types of disputes. More specifically, one major thrust contained in the paper is the presentation of techniques for modelling preferences within the GMCR using probability theory, fuzzy sets and grey numbers. A second set of papers deal with basic structures of conflict which can be expressed within a GMCR structure: hierarchical conflicts, misunderstanding in disputes and multi-level options. Finally, one paper is concerned with fairly allocating water among competing users employing decentralized optimization.

2 Group Decision and Negotiation

As described by authors such as Kilgour and Eden [1] and Hipel [2, 3], a rich range of formal techniques and methodologies are available for modelling controversies arising in group decision and negotiation. Of particular interest here is the Graph Model for Conflict Resolution for investigating real world disputes occurring in energy development, water resources, environmental management, international trade, industrial development and many other areas [4, 5]. This methodology can be applied in practice to actual conflicts by using the decision support systems such as GMCR II [6, 7] or GMCR+ [8].

A GMCR model consists of three key pieces of information: decision makers (DMs), the options or courses of action under the control of each DM and the relative preferences among the feasible states or scenarios in the conflict. Because preferences are relatively difficult to obtain in practice and there may be high uncertainty contained in them a number of mathematical approaches have been proposed for capturing their uncertainty including unknown preference information [9], fuzzy sets [10], probability theory [11] and grey numbers [12]. Another approach for dealing with situations in which a DM may greatly prefer one situation (ex. peace deal is reached) over another (war breaks out) is called strength or level of preference [13, 14]. As explained in the next section papers contained within this stream contain a range of advances in modelling uncertain preferences within the GMCR paradigm. These contributions can be operationalized by including them within expanded versions of DSSs for GMCR or developing new systems. The matrix formulation of a conflict [15] can reduce computational time within a DSS for implementing GMCR.

Some basic structures could also be embedded within GMCR to further enhance its applicability. For instance, in some cases, a hierarchical structure of conflicts may be present and hence one may wish to reflect this within GMCR [16]. In situations in which misunderstanding or misperceptions are present, one may wish to take into account what is called a hypergame framework [17, 18]. For some disputes one may want to allow for levels in an option such as having a high, medium or low level of water supply available. These types of advancements are addressed in this stream of papers.

The fair allocation of resources constitutes an important problem in many fields such as fairly distributing bandwidth among broadcasting stations in the communications industry and equitably allocating water among competing users in a river basin. Based upon concepts from hydrology, economics and cooperative game theory within an overall large scale optimization problem, Wang et al. [19] developed a comprehensive model for fairly allocating water among users with application to the South Saskatchewan River Basin in the Canadian Province of Alberta and the Aral Sea.

3 Contributions Contained in This Stream of Papers

The first 19 references contained in the bibliography are additional references used in this introduction. The last ten references refer the papers contained in this stream. References 20 to 22 are full papers while references 23 to 29 are extended abstracts. The paper by Kornis et al. [20] nicely demonstrates how GMCR can be applied to study the dispute over fluctuating water levels in the Great Lakes using the DSS GMCR II [6, 7]. Next, Hou et al. [21] model how three-levels of preferences can be obtained using what is called option prioritization.

For the papers in which extended abstracts are provided, the first set of papers is mainly concerned with preference uncertainty. In particular, after defining a solution concept called symmetric sequential stability, Rego and Vieira [22] extend it for employment with uncertain, probabilistic and fuzzy preferences. The same authors [23] then furnish matrix methods for calculating stability when preferences can be probabilistic.

The next three papers deal with different structures that can be handled within GMCR. Specifically, within a hierarchical graph model, He et al. [24] present option prioritization methods for determining preferences in a higher level conflict from lower ones. This is followed by Aljefri et al. [25] show how misperception of options by DMs can be formally handled within GMCR. Matbouli et al. [26] then explain how options can be split into levels within a graph model structure. Finally, Xiao et al. [27] develop a modified penalty based decentralized optimization method for employment in fairly allocating water among competing stakeholders.

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Negotiation Support Systems and Studies

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1 Introduction

Business and personal interactions increasingly take place online. Such interactions vary from personal communications (e.g. using email, twitter, skype) to formal organisational processes such as procurement, sale, or marketing. What they have in common is that they all deal with communication of different sorts. Concentrating on the business context, communication gets more structured. Mutual understanding becomes a prime goal in order to enable effective business interactions.

Electronic negotiations are an archetype of organizational communication processes that involve decision making and conflict management at the same time. Whilst negotiators in organisational e-negotiation processes might use general communication systems such as email or skype, there are also systems that are more specifically targeted at e-negotiations. They can be support tools as part of business systems or dedicated electronic support systems (NSSs). NSSs support communication, decision making, document management, and/or conflict resolution in business contexts. Over the past decades, we have seen sophisticated NSSs that provide holistic support of all of the above negotiation elements. They have been tested in various experiments and have been shown to improve both process and outcome.

The papers of this section as well as of the accompanying volume [1] show the work of researchers, developers, and practitioners who design and develop NSSs, study their use in the laboratories and in the field, or incorporate NSS components into negotiation, mediation and facilitation. In particular, the papers deal with: (1) communication and language aspects, (2) behavioural aspects, (3) system and media aspects, and (4) new applications of NSSs.

2 Communication Negotiation Support Systems and Studies

Communication is the core functionality of negotiations present in any context, by any stakeholder, using any medium or system. Thus, communication support must be a core functionality of an NSS.

The keynote by Schoop [2] addresses this need for dedicated communication support. With two communication theories as a firm basis, different aspects of communication support in electronic negotiations such as semantic and pragmatic

message elements and validity claims as meta-communication are introduced. The theoretical constructs have been implemented in the negotiation support system Negoisst which is also discussed in the paper. Schoop shows the role communication support plays for electronic negotiations.

The paper by Schoop et al. [3] provides the basis for communication support in NSSs by analysing the role of ontologies in electronic negotiations. Since the overall goal of communication support is mutual understanding, ontologies can provide the means to achieve understanding on the syntactic as well as the semantic level. Combined with pragmatic support in an NSS, this would enable a complete support of negotiation communication on all semiotic levels.

The paper by Kersten [4] analyses how negotiations can contribute to the acquisition of English as a second language in a university course. The students of the course were provided with academic negotiation publications and used an NSS to try out the concepts in practice. Communication practice is of prime importance when learning a new language. Together with joint problem solving, these negotiation components helped the students in their learning tasks.

3 Behavioural Aspects in Negotiation Support Systems and Studies

Negotiations involve at least two stakeholders in interaction processes. These negotiators make decisions and concessions, show emotions, and behave in different ways during the negotiation process based on their cultural context.

The paper by Vetschera [5] addresses the interdependence of behaviour of negotiators, in particular the sequence of offers they are making. It extends the Actor-Partner Interdepence Model, which was specifically developed for the analysis of data resulting from dyadic interactions, to the specific situation of negotiations. Results from applying this model to two data sets identify some robust patterns, but also indicate that interaction processes are strongly dependent on the negotiation task.

The paper by Etezadi and Kersten [6] studies multi-bilateral negotiations, in which one buyer simultaneously negotiates with multiple sellers and analyses how the negotiation tactics of the buyer influence behaviour of the sellers. The authors estimate a simultaneous equations model using data of 229 experimental negotiations. Their findings confirm the asymmetric role of reciprocity, in that competitive tactics are reciprocated, but sellers try to exploit cooperative buyers.

The paper by Sundarraj and Morais [7] raises the question how culture determines a particular behavioural issue, namely time preference. They envision testing time preference in a cross-cultural experiment with students from Brazil and India.

The paper by Gettinger and Köszegi [8] deals with aspects of affective complexity in electronic negotiations. Its management is fundamental for negotiators to reach mutual understanding in communication and a positive relationship. They propose to support electronic negotiations with communication tools that facilitate the contextualization of communication by providing emoticons.

4 Medium and System Aspects of Negotiation Support Systems

Negotiation Support Systems exploit the potential of information and communication technology to enable or to improve electronic negotiation processes and lead to better outcomes.

The paper by Moura and Costa [9] introduces an NSS called NegPlace that considers personality traits of negotiators for the support of electronic negotiation processes. The ultimate aim is to improve the negotiation by considering individual styles of the participants.

The paper by Sugimoto et al. [10] discusses a study of decision making in crisis management. Japanese and British students. The authors compare face-to-face scenarios to online scenarios in this context and analyse the differences. They show the need for dedicated ICT support.

5 New Applications of Negotiation Support Systems

The paper by Lenz et al. [11] introduces the field of requirements analysis to electronic negotiations and vice versa. Electronic requirements negotiations involve multiple stakeholders and are multi-attribute negotiations by nature. Surprisingly, the majority of previous work on such negotiations stems from the requirements engineering community. The authors discuss the particulars of requirements negotiations and show that NSSs can provide the means for support.

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Online Collaboration and Competition

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1 Overview

Large corporations have been leveraging the Internet for melding functional silos and for creating a ubiquitous set of inter-organizational business partners who collaborate with one another on various planning and operational activities. With the entry of social media, the scope for online collaboration and competition has expanded even further, in terms of both the geographic spread, as well as the real-time nature of the decisions that need to be taken. All of these necessitate the incorporation of newer methodologies.

One theoretical base for online technologies is rooted in the area of psychology. For example, what constructs are crucial in determining the onset and dynamics of an online interaction? Further on, how can such constructs be modeled mathematically and what techniques can be used to take real-time decisions on the basis of such models? Novel collaboration tools can be applied in a variety of contexts. The relevant question then is how can generic models be adapted to a particular known application area? Are there newer forms of applications that have arisen as a result, and if so, what models are most adaptable? Finally, there is the issue of social and customer acceptance of online systems. That is, what factors lead to the acceptance and adoption of various online technologies?

The aforementioned discussion leads us to thematically divide the papers in Section 8 of this volume and in [1] into the following three groups:

1. Online Technology Constructs and Models
2. Applications online technologies
3. Acceptance of online technologies.

2 Models and Constructs

One common approach to developing online tools is agent-based systems. Agents are software programs that act autonomously on behalf of a user and interact with other users or agents. Robertson and Franco [2] consider the question of how knowledge can be transferred through the use of inter-group interaction, and employ an agent-based approach for this purpose. Multi-agent coordination is also the underlying mechanism in an online system for managing consumer-collectives of renewable energy. Algorithms for the demand-management of this collective, and salient computational results with the algorithms are given in [3]. Online systems today provide a unique way

for organizations to elicit the participation of the public (e.g., through crowdsourcing). Antecedents constructs for which crowdsourcing becomes useful for the organization are proposed in [4].

3 Applications

At the organizational level, collaborative technologies can be used for decision-making by multiple stakeholders. A multicriteria decision-making model for assessing cloud-computing investment decisions is given in [5]. Online collaborative technologies allow for the possibility of engaging the mass population at large. Thus, these multicriteria methods can also be employed at the end-customer level as well, especially with the prevalence of online shopping. One such application of an AHP-based approach to determine the factors that influence customer shopping can be found in [6].

4 Acceptance

Collaborative technologies offer new marketing possibilities, for example, that of attracting customer through location-based electronic coupons. A customer's intention to re-purchase electronic coupons is affected by the quality of service of both the coupon-distributor and that of the store [7]. In addition to marketing, online tools are also influencing human courtships [8]: a survey of online-dating-site users found that looks and temporary physical encounters are not important for both men and women, although men are more in hurry to find a mate.

A number of research studies have brought out how trust and its sub-constructs are important in determining the acceptance of online collaborative technologies. In the case of longitudinal use of one such group decision-support-system, one trust sub-factor, namely risk-perception, decreased with the usage of a system [9]. Trust can also have an influence on global teams that engage in virtual collaboration [10].

Finally, the question is how does the acceptance of collaborative technology change across time and region? Using the US and Australia as examples, it is shown that even though technology access varies across these geographies, the perceived impact is more affected by the length of use rather than by the end-user's regional origin [11].

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Market Mechanisms and Their Users

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1 Overview

Online marketplaces represent ideal playing fields for market engineers and researchers in decision-making on mechanisms and aspects of information presentation. Rules and mechanisms for markets vary widely and continue to evolve, especially with the increasing amount of computer power which permits developing and implementing complex, memory-intensive mechanisms like combinatorial auctions. The other major factor in exchange transactions are the market participants and their interaction with such systems and the mechanisms. How humans react to specific set of market rules and principles determines the success or failure of this market. This introduces behavioral aspects to market design considerations.

Explaining and predicting user reactions to market design as well as designing new and more efficient forms of market mechanisms are therefore two of the most urgent tasks for researchers from many fields—including information systems, operations research, economics, and social and political sciences. Phenomena like auction fever, overbidding, information overload, social competition, and other forms of social preferences and behavioral biases illustrate this notion. The papers included in this section as well as the papers included in the accompanying volume [1] address such aspects and they can be divided into the following three groups:

1. negotiations and auctions;
2. peer-to-peer markets; and
3. emotions in markets.

2 Negotiations and Auctions

Complex market mechanisms, especially in business-to-business auctions, have attracted a good deal of attention in research and practice in the last decades. Auctions and formal negotiation structures represent a possible means of reaching agreements between the involved parties, where usually auctions follow well defined rules and negotiations often do not. In this volume, a series of suggestions are made for applying or combining negotiations and auctions to relevant problems.

A multi-attribute view on the auction market place eBay is considered in [2]. The authors use multiple (parallel) auctions on the same product type with different feature

properties, taking advantage of large auction numbers, the price variation therein, and different feature characteristics that fit the bidders' specific preferences.

Another type of auctions is the first-price sealed-bid auction. A special case, in which the responsibility for bid and payment is split is discussed in [3]. Such a division of responsibility may be due to the principal-agent relationship that arises between the bidder and the payer. In two-unit two-bidder scenarios, the effect of overall allowances for one and two units on bidding equilibria are compared. Overall allowances for two units result in an equilibrium with no single-unit bids; only if single-unit allowances exceed two-unit allowances do the agents place single-unit bids.

Two contributions consider supply chain environments. A two-stage multi-echelon supply chain model is introduced in [4]. A numerical example is used to compare the different order and production lot determination approaches that involves central planning (optimization) as well as decentralized negotiations.

Inefficiencies in reverse procurement auctions in just-in-time production environments due to non-linear contract curves with interrelated product or service attributes are discussed in [5]. In order to improve auction efficiency, in terms of outcomes for both sides, post-auction multi-bilateral negotiations are suggested.

3 Peer-to-Peer Markets

Another evolving form of online markets are peer-to-peer platforms. Today's e-commerce landscape experiences the development of a broad variety of such markets. Whereas the last decade was mainly characterized by B2C e-commerce, we now see an increasing number of C2C platforms: private persons share goods and services in large scale peer-to-peer networks. Ebay, for instance, may be regarded as one of the early pioneers in provisioning and managing such a C2C market platform. The spectrum of sharing activities nowadays shifts from mere resale of spare goods to other forms (e.g., co-usage and renting. The proponents of these markets often claim that they offer a more social and sustainable alternative to traditional forms of consumption.

Knowledge of the factors that are used to determine pricing help us to better understand its functioning. The factors that determine prices on the apartment sharing platform Airbnb can be determined with the standard regression analysis [6]. The prices are set by the individual providers, usually private persons, and thus reflect a wide range of influences. The model explains app. 35% of the listing prices' variation, which includes size and location of the place as well as city-specific aspects like population and the general rent price level. The approach allows to obtain such insights into city structures as listing density and spatial price variations.

Another key issue in sharing economy is trust. Using the case of Airbnb the formation of trust is discussed in [7]. The authors propose a model that captures trust-relevant factors such as the hosts' ratings, activity, and trustworthiness as conveyed by their profile pictures and links those factors to booking intention, i.e., the economic manifestation of trust.

4 Emotions in Markets

It is common consensus by now that emotions play a large part in decision-making. Determining the exact circumstances under which certain emotions arise and how they shape the behavior of market participants, however, is still a relatively novel research field today. Inexpensive and small sensors, which are now commonly available, can be used to help consumers improve their decision making, e.g. in a purchase situation. In turn, market providers may use this information to improve their mechanisms, e.g., to choose less (or more) stress- or excitement-inducing auction formats.

In the context of C2C market platforms, a research model of the relationships between cues to trust, trust, emotions and purchase intention in order to increase understanding of C2C market stability is proposed [8]. Cues to trust are further differentiated as heuristic cues—e.g. interest similarity between consumers—or independent cues which have no connection to the consumer's actual decision or purchase situation (e.g. shared birthdays). One major part in the proposed research is better understanding the role of emotions in cue processing and trust formation.

Further developments in this area include adaptive systems with biofeedback applications which adapt to individual and situational consumer needs [8]. Such systems pose new challenges for businesses in terms of data analysis and market engineering: Structuring, processing and interpreting consumers' behavioral data enhanced with biodata is a complex task. Designing stable markets and systems based on such data requires highly skilled analysts and (adaptive) analytics systems.

A framework for integrating NeuroIS methods into business analytics to improve corporate processing and analyze large volumes of consumer and market data is proposed in [9]. The authors suggest adaptive analytics systems, e.g., systems based on biofeedback, to help business analysts improve their decision-making skills.

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