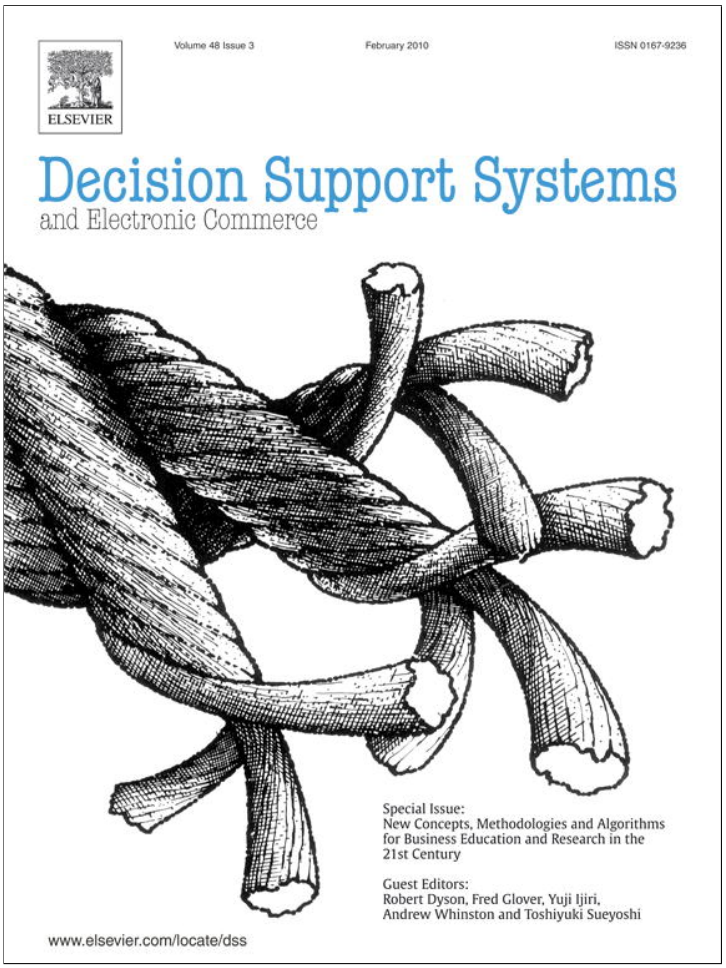
Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

http://www.elsevier.com/copyright

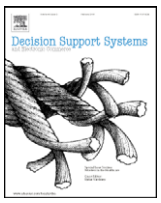
Author's personal copy

Decision Support Systems 48 (2010) 427–429

Contents lists available at ScienceDirect

Decision Support Systems

journal homepage: www.elsevier.com/locate/dss



New concepts, methodologies and algorithms for business education and research in the 21st century

Introduction

Over a long and remarkably productive career, Professor William W. Cooper has made many pioneering contributions in a variety of fields. He has 545 scientific professional publications in the field of accounting, mathematics, operations research, management science, engineering, economics, public policy, and behavioral sciences. The publication record reflects Professor Cooper's wide interdisciplinary scholarship. More importantly, the number of Professor Cooper's former doctoral students is now over 200. They are actively engaging in education and research in various disciplines and countries.

To commemorate the 95th birthday (July 23, 2009) of Professor Cooper, we have prepared two articles and a special issue in this journal. The two articles, listed below, describe his contributions in the areas of OR/MS (Operations Research/Management Science) and accounting, representing the fields where his main research interests lie, and in which his work has had an enduring impact.

(1) F. Glover and T. Sueyoshi (2009), "Contributions of Professor William W. Cooper in Operations Research and Management Science," *European Journal of Operational Research*, Vol. 197, No. 1, pp 1–16.
(2) Y. Ijiri and T. Sueyoshi (under review), "Revisiting Accounting Essays by William W. Cooper: In Commemoration of His 95th Birthday," *ABACUS: A Journal of Accounting, Finance and Business Studies*.

The first article summarizes Professor Cooper's pioneering contributions in OR/MS, with notable forays into the areas of linear and nonlinear programming, goal programming, chance-constrained programming, data envelopment analysis, and manpower planning, among others. His legendary partnership with Professor Charnes has provided results whose connections go back to the 18th century, bearing on problems conceived but left unsolved by Laplace and Gauss. The article documents such cross-fertilizing links among Professor Cooper's multiple research focuses, and their impacts on other researchers in OR/MS.

The second article selects twelve articles written by Professor Cooper as "revisiting essays". Although the selected essays were published in accounting journals, they are still important and offer insights relevant to the recent financial crisis, making it particularly worthwhile to visit them anew. In an effort to summarize the twelve articles, the second article utilizes an "excerpt method" that describes the essential part of the twelve articles, along with postscripts (i.e., commentaries) for each essay. This article integrates Professor Cooper's interest in macro accounting (e.g., social accounting) and micro accounting (e.g. enterprise accounting) to describe his philosophical and conceptual contributions in accounting. The article draws alike on perspectives originating from his mentor (Professor Eric L. Kohler), thereby providing his global vision in social science. The global aspect of Professor Cooper's contributions in accounting provides a significant complement to his methodological contributions in OR/MS summarized in the first article, disclosing the unusual depth and scope of his works.

The accompanying articles in this special issue focus on contributions of scholars who are following Professor Cooper's tradition by research that is still having an impact on the IT (Information Technology) related business education and research in the 21st century. These contributions are summarized in the following eight articles:

(1) M. Better, F. Glover and M. Samorai, "Classification by Vertical and Cutting Multi-Hyperplane Decision Tree Induction".

The first article extends goal programming proposed by Professor Cooper into an advanced form of Discriminant Analysis (DA). Conventionally, two-group classification is widely used in DA for decision making and data mining applications. To explore the use of DA further, the authors introduce two new mixed integer-programming formulations that produce multiple separating hyperplanes for more flexible and effective classification. This work represents a generalization of previous piecewise-linear models that embed rules, having the form of hyperplanes, to separate successively the two groups. The classifiers incorporated in the proposed DA approach yield a particular collection of decision trees that grow in depth and not in width. The research shows that the proposed DA approach achieves better classification accuracy in less time than previous DA approaches in mathematical programming.

(2) C. Kao and S.N. Hwang, "Efficiency Measurement for Network Systems: IT Impact on firm Performance".

The second article describes the use of network DEA (Data Envelopment Analysis) in measuring IT impact on corporate performance. It is widely known that Professor Cooper has invented DEA and dedicated his research effort for various types (model, theory and application) of DEA development. Following his research effort, the second article discusses the internal structure of a business system where multiple components cause inefficiency in a complicated manner. To deal with such business complexity, the authors propose an extended network DEA model that attributes the system inefficiency to its component processes. They apply the proposed DEA network model to assess the IT impact on firm performance in a

0167-9236/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.dss.2009.06.001

Author's personal copy

banking industry. The research shows that the impact of IT on firm performance operates indirectly through fund collection. The level of IT impact increases when a firm shares the IT budget with its profit generation process.

(3) M. Goto, "Financial Performance Analysis of US and World Telecommunications Companies: Importance of Information Technology in the Telecommunication Industry after the AT&T Breakup and the NTT Divestiture".

The third article investigates the financial performance of the world telecommunications firms by DEA-DA. In the sense, this study follows the research legacy of Professor Cooper. Professor Cooper and his associates have published on the divestiture of AT&T (American Telephone & Telegraph) in *Management Science* (1988) which many scholars have paid attention to both his claim on the methodological bias (i.e., different methods produce different results) and their exchange with well-known economists (one of them became the Nobel Prize Laureate). The proposed use of DEA-DA has an important feature that it has a linkage in Altman's *Z* score. The *Z* score has long served as a methodological and conceptual basis in finance. Based upon the *Z* score of telecommunications firms, the author ranks the firms for financial assessment. After evaluating their financial performance, the author pays attention to AT&T and NTT (Nippon Telegraph and Telephone) after their divestitures. The study finds that AT&T has outperformed NTT because AT&T has changed itself to an IT company that provides wireless communications services and other various types of IT service, but NTT has separated the IT and wireless services into the other companies after its breakup. Thus, the author claims that IT is an important business component in the telecommunications industry.

(4) T. Sueyoshi, "Beyond Economics for Guiding Large Public Policy Issues: Lessons from the Bell System Divestiture and the California Electricity Crisis".

The fourth article discusses the existence of a methodological bias in guiding large policy issues such as the AT&T breakup. The research concern of Professor Cooper is that if we depend upon a single methodology (i.e., econometrics) and/or a single science (i.e., economics), then we often derive a biased conclusion. Hence, we need to apply multiple methodologies and multiple sciences when we examine a large public policy issue. Following his suggestion, the research has investigated why the California electricity crisis has occurred during the summer (2000) when wholesale electricity prices in California were approximately 500% higher than those during the same months in 1998–1999. This study finds that the price hike has occurred due to an increase in fuel prices and real demand. The change of the two market fundamentals explained 45.73% of the price increase and fluctuations during the crisis. The responsibility of energy utility firms was 21.41%. The policy implication regarding the California electricity crisis is different from well-known economic studies that have attributed the price hike to the exercise of market power. The difference points up a need for drawing on researchers from multiple disciplines who are capable of checking each other's methodologies in guiding large policy decisions. Thus, Professor Cooper's claim is still important and useful in guiding large public policy issues although the fourth article utilizes an advanced artificial intelligent approach, or so-called "agent-based approach".

(5) Y. Jiang, J. Shang and Y. Liu, "Maximizing Customer Satisfaction through an Online Recommendation System: A Novel Associative Classification Model".

Professor Cooper has paid much attention to the research in the area of marketing. He developed innovative models to optimize resource allocation for alternative media advertising. In the 1960s, Professor Cooper and his associates built a strategic decision model, DEMON, for marketing new products and they published it in *Management Science* and *Journal of Marketing Research*. His idea of creating a decision support system to aid with marketing decision making inspires the fifth article. The authors developed online-personalized recommendation services to help in improving customer satisfaction. Conventionally, a recommendation system is considered a success if clients purchase a recommended product. However, the act of purchasing itself does not guarantee satisfaction and a truly successful recommendation system should be the one that maximizes the customer's after-use gratification. By employing an innovative associative classification method, they propose an online recommendation system that is able to predict a customer's ultimate pleasure. Based on customer's characteristics, a product is recommended to a potential buyer if the proposed system predicts a high level of buyer's satisfaction.

(6) D. Zhu, "A Hybrid Approach for Efficient Ensembles".

An ensemble of classifiers, or a systematic combination of individual classifiers, often results in better classifications in comparison to a single classifier. However, we often wonder which classifiers we should combine to construct an optimal ensemble. Moreover, ensembles are often computationally expensive since they require the execution of multiple classifiers for a single classification task. To address such problems in data mining, the sixth article proposes a hybrid approach for selecting and combining data mining algorithms to construct ensembles by integrating DEA and stacking. Experimental results show the efficiency and effectiveness of DEA combined with stacking. It is widely known that DEA has been extensively used for performance evaluation in the public and private sectors. In addition to the conventional uses of DEA, the sixth article documents that we can use DEA as a methodological tool to ensemble multiple classifiers for data mining in computer science.

(7) C. Giannoulis and A. Ishizaka, "A Web-based Decision Support System with ELECTRE III for a Personalized Ranking of British Universities".

Professor Cooper is a well-known scholar in the area of multi-criteria decision making. For example, goal programming and DEA, initially proposed by Professor Cooper, are good examples of such multi-criteria decision-making methods. Following his research direction, the seventh article describes a new use of ELECTRE III, or a Web-based computer system, incorporating a multi-criteria decision method, that helps group decision making or so-called "groupware" by connecting many individuals via Internet. In the seventh article, the authors are interested in British university rank. They describe the use of the three-tier Web-based system of ELECTRE III, which produces a customized ranking of British universities by reflecting personal preferences, where information is uncertain and vague. It can be easily envisioned that the Web-based groupware, incorporating multi-criteria decision making, will be an important pedagogical tool for business education in the 21st century.

(8) F. Borrajo, Y. Bueno, I. Pablo, B. Santos, F. Ferrnandez, J. Garcia, and I. Sargedo, "SIMBA: A Simulation for Business Education and Research".

The eighth article describes a business simulator that can be used for decision making for business education where students can help other students in understanding business concepts and theory. Professor Cooper often discusses the importance of a simulation study in education and research by describing that research results need to be examined by a real data set(s) and a simulation study. Following his opinion, the eighth article introduces a new type of simulator for business education in Spain. The simulator has two unique features. One of the two features is that it serves as a Web-based platform for business education. It permits students to connect the simulator from any point on the Web, permitting both classroom education as well as distance education. The architecture of the

Author's personal copy

simulator permits not only the connection of corporate managers, but also software agents. The other unique feature is that it serves as a multi-agent platform for the creation, development and evaluation of intelligent agents that can manage companies like real managers. This type of simulator equipped with learning capabilities will be an important pedagogical tool for distance education in the 21st century.

Finally, we would like to extend our deep appreciation to Ms. Veronika Whinston (Managing Editor of this journal). She communicates very carefully and timely among authors, reviewers and the DSS office. Without her dedication and effort to the journal, we could not complete the special issue. Thank you very much.

Guest Editors
Robert Dyson
University of Warwick, United Kingdom

Fred Glover
University of Colorado, United States

Yuji Ijiri
Carnegie Mellon University, United States

Andrew Whinston
University of Texas at Austin, United States

Managing Editor for the Special Issue
Toshiyuki Sueyoshi
New Mexico Institute of Mining and Technology, United States
National Cheng Kung University, Taiwan
Corresponding author.
E-mail address: toshi@nmt.edu.

Robert Dyson has published extensively in the fields of cutting and packing, stochastic programming, financial modelling, strategic development, strategy support, data envelopment analysis and performance management. He was initially a research mathematician and senior systems technologist at Pilkington Plc (1964–70). Then, he joined Warwick Business School (WBS) in 1970 as a lecturer. He was Chair (Head) of WBS from 1978 to 81 and Dean from 1998 to 2000. He was a Visiting Fellow at Technische Hogeschool Twente, Enschede (1977) and Visiting Professor at the University of Texas, Austin (1982). Also, he was Pro-Vice Chancellor of the University in 1989–95 and 1999–2005, Chair of the UK Committee of Professors of Operational Research (1995–97) and President of the (UK) Operational Research Society (1998 and 99). He was elected the Companion of Operational Research (2007) award. He also served as Board Member of the Coventry Partnership (1998–2005), Governor of Kenilworth School (1989–98), Chair of Governors (1993–97) and presently Chair of the Trustees. He has been the Editor of the European Journal of Operational Research since 2006.

Fred Glover is Chief Technology Officer for OptTek Systems, Inc., and Distinguished Professor at the University of Colorado, Boulder. He has authored or co-authored more than 370 published articles and 8 books in the fields of mathematical optimization, computer science and artificial intelligence. He is the recipient of the von Neumann Theory Prize, and is an elected member of the National Academy of Engineering. His numerous other awards include those from the American Association for the Advancement of Science (AAAS), the NATO Division of Scientific Affairs, the Institute of Operations Research and Management Science (INFORMS), the Decision Sciences Institute (DSI), the Energy Research Institute (ERI), the Institute of Cybernetics of the Ukrainian Academy of Science, and the Miller Institute for Basic Research in Science.

Yuji Ijiri is the Robert M. Trueblood University Professor of Accounting and Economics, at Tepper School of Business, Carnegie Mellon University (CMU). He received his doctorate from CMU in 1963, and after having joined the faculty of Stanford Business School for four years, returned to CMU in 1967 where he has been on its faculty since then. He has also been on the editorial board of the *Journal of Accounting and Public Policy* since its inception in 1981. In 1982–93, he served as President of the American Accounting Association. In 1989, he was inducted into the Accounting Hall of Fame at Ohio State University. He has published 25 books and has over 200 journal publications in the fields of accounting, economics, and mathematics.

Andrew Whinston is the Hugh Roy Cullen Centennial Chair Professor in Information Systems at the McCombs School of Business in the University of Texas at Austin and directs the Center for Research in Electronic Commerce. In 2005 he was awarded the LEO Award for Lifetime Exceptional Achievement in Information Systems by the Association for Information Systems. His research interests include electronic commerce, knowledge management, online auctions, and financial markets. Whinston received a PhD in management from Carnegie Mellon University.

Toshiyuki Sueyoshi is a professor at Department of Management, New Mexico Institute of Mining and Technology. He is also a visiting professor at Department of Industrial and Information Management, National Cheng Kung University. He received his PhD from the University of Texas at Austin. He completed his PhD thesis under the supervision of Professor William W. Cooper.