This paper describes a method for the assessment of retail store performance based on DEA. The assessment considers the stores aggregate several subunits, corresponding to sections with management autonomy. This motivated an analysis at the section level and the store level. The performance assessment of the sections involves a comparison among similar sections located in different stores, and evaluates efficiency spread. This is followed by an analysis at the store level to define targets for the sections by using a Network model that takes into account the sections share limited resources.

3 - Analyses of investment efficiency using network DEA

Hirofumi Amatatsu, Information Science of Graduate School of Engineering, Seikei University, 3-3-1 Kichijoji-Kitamachi, 180-8633, Musasino-shi, Tokyo, Japan, amatatsu@mint.ocn.ne.jp, *Tohru Ueda*

Enterprises have been investing to keep their positions in markets or to make new positions. Central and local governments have also been doing similar activities. In this paper we propose DEA algorithms to evaluate efficiency of these investments using financial reports and input-output tables for multiple periods. The algorithms include 1) Dynamic DEA algorithms for simple organizations 2) Dynamic DEA algorithms for matrix type network organizations and 3) Malmquist productivity indexes.

4 - Retail chain performance evaluation using Data Envelopment Analysis

Vassilis Dedoussis, Industrial Management & Technology, University of Piraeus, 80 Karaoli & Dimitriou str., 185 34, Piraeus, Greece, vdedo@unipi.gr, *Stella Sofianopoulou*

The efficiency of a retail chain is a major issue in the retailer's competitiveness, since its profitability depends on the profitability of its parts. Data Envelopment Analysis is employed for resolving this problem in a fast food retail chain and assessing managerially useful measures of store-level retail productivity. The mathematical model created is multidimensional and accepts multiple inputs and outputs, both quantitative and qualitative for every outlet, which are then used as tools for measuring the technical efficiency of the stores. Computational results from a real-world test case are presented.

■ WD-07

Wednesday, 14:00 - 15:20
8.2.47

Project Scheduling

Stream: Project Management and Scheduling [c]
Contributed session

Chair: *Premysl Sucha*, Department of Control Engineering, Czech Technical University, Faculty of Electrical Engineering, Karlovo namesti 13, Prague 2, 121 35, Prague, Czech Republic, suchap@fel.cvut.cz

1 - Time-cost tradeoffs under time and cost chance constraints

Zohar Laslo, Industrial Engineering and Management, SCE-Shamoon College of Engineering, Bialik/Bazel Strs, 84100, Beer Sheva, Israel, zohar@sce.ac.il, *Gregory Gurevich*

Seeking for the improvement of the project planning, we analyzed two current procedures and a new developed procedure for crashing the project completion by additional budget. We consider a project with various types of activities where the randomness of their duration derives from external uncertainty, internal uncertainty or both of them and where correlation between their actual cost and random duration is known. The objective is to 'optimize' the allocation of budget among project activities, seeking to minimize the budget, subject to any chance constrained contractual due date.

2 - Social Network Analysis of project partnership

Blazenka Divjak, Faculty of organization and informatics, University of Zagreb, Pavlinska 2, 42 000, Varazdin, blazenka.divjak@foi.hr, *Nina Begicevic*, *Petra Peharda*

In this paper we present a research on the social network of project partnership in the EUREKA network. The main method used is the Social Network Analysis. Two hypotheses were set: H1 Countries from the same region cooperate more among themselves than with the countries from any other region. H2 Central countries in the social network of partnership in EUREKA projects are developed countries. We tested the hypotheses on countries from Northern, Central, Mediterranean, Western and South-Eastern and Eastern Europe. The results indicate that countries from the same region cooperate more with the countries outside the region and that the central countries in the social network are developed countries.

3 - Flexible Human Resource Management through Decision Support Systems - A Case-Study in a Contact Center Outsourcer

João Justino, HR Department, Teleperformance Portugal, R Alexandre Braga 25-B, 1150-003, Lisboa, Portugal, jj1165@acuity.pt, *Joao Telhada*

Managing the relationship with employees, while keeping high levels of quality in customer satisfaction, has been a continuous challenge for business managers. Usually this relationship is strict, thus introducing flexibility is a breakthrough innovation that can only be achieved in a business intelligence framework. A case study is presented describing the design, adoption and implementation of a intelligence system in a contact center outsourcer for managing the usage of operators in a flexible way. Some indicators are given that illustrate the importance of such systems.

4 - Take-give Resources in Project Scheduling with Time Windows

Premysl Sucha, Department of Control Engineering, Czech Technical University, Faculty of Electrical Engineering, Karlovo namesti 13, Prague 2, 121 35, Prague, Czech Republic, suchap@fel.cvut.cz, *Zdenek Hanzalek*

The problem that we address in this work is motivated by a real scheduling problem from a lacquer production which is seen as the project scheduling problem with general temporal and resource constraints. In addition, there are special resources called take-give resources that are needed from the beginning of an activity to the completion of another activity. In addition, we consider sequence dependent changeover time on take-give resources. We suggest two heuristic solutions to solve the problem. Performance of both heuristics is evaluated on a set of lacquer production benchmarks.

■ WD-08

Wednesday, 14:00 - 15:20
6.1.36

Various Advances on Management and Scheduling II

Stream: Project Management and Scheduling
Invited session

Chair: *Erwin Pesch*, FB 5 - Institute of Information Systems, University of Siegen, Hoelderlinstr. 3, 57068, Siegen, Germany, pesch@fb5.uni-siegen.de

Chair: *Gerhard-Wilhelm Weber*, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr

Chair: *Edmund Burke*, School of Computer Science & IT, University of Nottingham, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, United Kingdom, ekb@cs.nott.ac.uk

1 - Evaluation and comparison of project management software

Vassilis Kostoglou, Department of Informatics, Alexander TEI of Thessalon iki, P.O. Box 141, 57400, Thessaloniki, Greece, vkostogl@it.teithe.gr

Most projects are characterized by complexity due to their size, the requirement for scheduling of tasks and tracking of progress, and the dire need for using their resources efficiently. A large number of relevant software is available to project managers. This work examines thoroughly and evaluates 12 selected project management programmes on six introduced main criteria, each consisting of several components. All programmes are tested and ranked for every criterion and aggregately according to their scores on a five grade scale. Software performances are commented and conclusions are drawn.

2 - On Resource Complementarity in Activity Networks — Preliminary Results

Helder Silva, IFAM - Instituto Federal de Educação, Ciência e Tecnologia do Amazonas, Rua Governador Danilo Areosa S/N,

69075351, Manaus, Amazonas, Brazil, helder@ifam.edu.br, *Anabela Pereira Tereso, José Oliveira*

The methodology of project management has been widespread in organizations of different functions and sizes. In this context, we address the issue of optimal resource allocation, and more specifically, the analysis of complementarity of resources (primary resource and supportive resource) in a project. We develop a conceptual system capable of determining the ideal mixture of resources allocated to the activities of a project, such that the project is completed on time with minimal cost. In this paper, we present the mathematical model, development details and the preliminary results obtained.

3 - Forming a balanced team

Stanislaw Walukiewicz, Systems Research Institute, Polish Academy of Sciences, ul. Newelska 6, 01-447, Warsaw, Poland, Stanislaw.Walukiewicz@ibspan.waw.pl

We formulate the problem of formation an effective team, using the terms following Belbin. Next, we reformulate the approach using the concept of social capital and proximity. By social capital we understand formal and informal relations between at least two people. As they are not disjoint, we study proximity - specific interrelations linking people solving a given problem. We show that there are four forms of proximity and that they are mutually disjoint. We compare our approach to the existing balancing methods.

4 - Modular Operational Support System (OSS) to Cutting Processes Parameters Optimization

Elesandro Baptista, Industrial Engineering Post Graduation Program, UNINOVE-Nove de Julho University, Av. Francisco Matarazzo, 612, 05001-100, São Paulo, São Paulo, Brazil, elesandro@uninove.br, *Nivaldo Coppini*, *Êmili Haguihara*

Cutting processes management has great value to industrial companies. Normally, currently used operational conditions are based on tool maker's catalogs and on the operator experience. It is undisputed that each manufacturing scenario has its own characteristics and the optimized conditions can be achieved mainly with collected data from their own shop floor experience. The aim of this paper is to develop a project for a modular Operational Support System (OSS) that allows the user to optimize cutting process parameters in its own manufacturing scenario in real time with the process.

■ WD-09

Wednesday, 14:00 - 15:20
6.2.53

Convex Duality in Mathematical Programming

Stream: Mathematical Programming

Invited session

Chair: *Sorin-Mihai Grad*, Faculty of Mathematics, Chemnitz University of Technology, 09107, Chemnitz, Sachsen, Germany, grad@mathematik.tu-chemnitz.de

Chair: *Gerhard-Wilhelm Weber*, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr

1 - On a zero duality gap result in extended monotropic programming

Radu Ioan Bot, Faculty of Mathematics, Chemnitz University of Technology, Reichenhainer Str. 39 Zi. 612, 09107, Chemnitz, Germany, bot@mathematik.tu-chemnitz.de, *Ernö Robert Csetnek*

In this presentation we discuss and improve a zero duality gap statement given in [D.P. Bertsekas, Extended monotropic programming and duality, Journal of Optimization Theory and Applications 139 (2), pp. 209-225, 2008] for an extended monotropic programming problem. To this aim we use some convex analysis specific techniques based on subdifferential calculus, whereby a determinant role is played by a generalization of the Hiriart-Urruty - Phelps formula.

2 - Duality for vector optimization problems via a general scalarization

Sorin-Mihai Grad, Faculty of Mathematics, Chemnitz University of Technology, 09107, Chemnitz, Sachsen, Germany, grad@mathematik.tu-chemnitz.de, *Radu Ioan Bot*

Considering a vector optimization problem to which properly efficient solutions are defined by using convex cone-monotone scalarization functions, we attach to it, by means of perturbation theory, new vector duals. When the primal problem, the scalarization function and the perturbation function are particularized, different dual vector problems are obtained, some of them already known in the literature. Weak and strong duality statements are delivered in each case. Thus we extend to a more general framework the results presented in our contribution to the previous EURO Conference from Bonn.

3 - Conjugate Duality in Multiobjective Optimization

Gert Wanka, Faculty of Mathematics, Chemnitz University of Technology, Chemnitz University of Technology, Faculty of Mathematics, D-09107, Chemnitz, Germany, gert.wanka@mathematik.tu-chemnitz.de

This paper is devoted to some concepts and results regarding duality for convex vector optimization problems. We consider problems with and without geometric and cone constraints and deal with Lagrange, Fenchel and Fenchel-Lagrange duality. We establish weak, strong and converse duality results accompanied by necessary and sufficient optimality conditions.
References
R. I. Bot, S.-M. Grad, G. Wanka, Duality in vector optimization. Springer-Verlag Berlin Heidelberg 2009

4 - A new and condensed linearization algorithm for an important branch of Linear Fractional Programming Problem

Reena Kapoor, mathematics, delhi university, j-5/4a krishna nagar, Delhi, 110051, Delhi, Delhi, India, reena_3105@rediffmail.com

This paper deals with Linear Fractional Programming Problem with bounded variables under the restriction: absolute value of the denominator is greater than or equal to M0. An example is constructed to show importance of the problem in real world. One way to solve the problem is: divide it into two separate LFPP and apply Charnes-Cooper Method. The underlying contribution of this paper is: it provides a compact process that linearize the considered problem at one go. Comparative study of two techniques is also given. An example and the codes and data sets for the procedure are given in the end.

■ WD-11

Wednesday, 14:00 - 15:20
8.2.38

Advances in the Use of Information Technology IV

Stream: Emerging Applications of OR

Invited session

Chair: *Sevgi Ozkan*, Information Systems, Middle East Technical University, ODTU Enformatik Enstitüsü, Ismet Inönü Bulvari, 06531, Ankara, Turkey, sozkan@ii.metu.edu.tr

Chair: *Gerhard-Wilhelm Weber*, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr

1 - Verification of the validity on the pattern of Royal e-customer purchasing behavior

Masashi Nakagawa, web business technology, The kyoto college of graduate studies for informatics, 606-8225, kyoto, Japan, nakagawa.3719@gmail.com, *Hong Seung Ko*, *Shasha Liu*, *Megumi Hiramoto*, *Takeshi Teramoto*

The visualization of e-customer behavior is a very key issue in e-business. It is needed to understand the e-customer behavior process and the purchase pattern to visualize an e-customer behavior. In this paper, we will check up that the e-customer who must be retained and took the behavior pattern of following up the 7 steps of behavior process brings out the profitable sales to a company. Consequently, we verify that the profitable sales are increased by the most valuable e-customer taking the 7 steps through the correlation analysis and the causal analysis.