To study the movement of individuals over occupational categories it is natural to start by looking at the movement of people between different categories. Since such moves are unpredictable at the individual level it is necessary to find a model to describe the mechanism of movement in probabilistic terms. We have used a markov model to describe this in a half open and half closed system. A measure of career pattern based on above model has been developed and the simulated distribution of this measure has also been studied. A numerical study has been done on the University of Calcutta, India.

2 - Dealing with observable and latent heterogeneity in Markov manpower systems

Marie-Anne Guerry, MOSI, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussel, Brussels, Belgium, maguerry@vub.ac.be

In modeling manpower systems, it is of crucial importance to deal with heterogeneity. Most of the manpower models are taking into account heterogeneity due to observable sources, neglecting heterogeneity due to latent sources. In this paper a multinomial Markov-switching model is introduced to deal with heterogeneity due to latent sources for the internal flows of the personnel as well as for the wastage flows. A re-estimation algorithm is presented to estimate the parameters of the Markov-switching manpower model.

3 - The dynamic behavior of a mixed push-pull manpower model

Tim De Feyter, Centre for Corporate Sustainability, Hogeschool-Universiteit Brussel, Stormstraat 2, 1000, Brussels, Belgium, tim.defeyter@hubrussel.be, *Marie-Anne Guerry*

In the mixed push-pull model, the internal mobility of a manpower system is regulated by push as well as pull transitions. The model is a generalization of the Markov and the Renewal manpower model. In this paper we study the dynamic and asymptotic behavior of the mixed push-pull model under the assumptions of time-homogeneity and a known constant recruitment policy and investigate the mechanisms underlying the difference with the dynamic behavior of the traditional push and pull model. We show that under certain conditions, the system evolves towards a limiting personnel distribution.

4 - Investigating Aspirations, Priorities and Optimization Opportunities in Markov Manpower Planning Models

Andreas Georgiou, Department of Business Administration, University of Macedonia, 156 Egnatia Street, 54006, Thessaloniki, Greece, acg@uom.gr

Integrating various optimization aspects in hierarchical manpower planning models has been of interest since the early introduction of these structures. Decision makers' aspiration levels and priorities are often contradicted by rigid constraints that can not be easily circumvented. This work presents ideas which can be employed in manpower nonhomogeneous markov systems which evolve in time, in an effort to reach satisfactory structures. Optimization approaches based on a general goal programming framework are considered and possible other variations that can be employed in this direction are investigated

5 - Control aspects in an enhanced manpower planning model

Nikolas Tsantas, Department of Mathematics, University of Patras, Department of Mathematics, University of Patras, 26500, Patras, tsantas@upatras.gr, *Vasileios Dimitriou*

This work deals with the exercise of recruitment control to a time dependent, hierarchical system which incorporates training classes as well as two streams of recruitment; one coming from the outside environment and another from an auxiliary external system. The motivation for this model lies in the need to take into account not only the tendency of the employees to attend seminar courses so as to improve their career prospects, but also the organizations' intention to avoid situations associated with the unavailability of skilled individuals for hiring.

■ MD-12

Monday, 14:00-15:20
8.2.39

AHP 04

Stream: Analytic Hierarchy Processes, Analytic Network Processes
Invited session

Chair: *Y. Ilker Topcu*, Industrial Engineering, Istanbul Technical University, Istanbul Teknik Universitesi, Isletme Fakultesi, Macka, 34367, Istanbul, Turkey, ilker.topcu@itu.edu.tr

1 - Finding Effective Strategies for Improving Textile and Clothing Supply Chain in Pakistan using SWOT Analysis and AHP

Deedar Hussain, Production and Systems Department, University of Minho, Portugal and NED University, Pakistan, University of Minho, Campus de Gualtar, 4710-057, Braga, Minho, Portugal, deedar_agha@hotmail.com, *Manuel Figueiredo*, Anabela Pereira Tereso, Fernando Ferreira

The global shift of textile and clothing manufacturing to low cost environments has created a strong competition in Asia and Far East. Old and new players are developing the missing links in the chain. Although they are at different development stages, they share the advantage of being suitable sources for low-value and standard products. Similar is the context for Pakistan which supplies mainly standard products of low added value. This study gets inputs from our previous work, "SWOT Analysis of Pakistan Textile Supply Chain" and aims to develop competitive strategies using Saatys AHP.

2 - Risk management in the process of foreign supplier selection: Case Study

Olga Fedotova, DEGEI, University of Aveiro, Campus Universitário de Santiago, 3810-193, Aveiro, Aveiro, Portugal, olgafedotova@ua.pt, *Luis Ferreira*

Managing risk in inbound supply chain operations has become increasingly important in today's competitive and globally environment. This research aims to reinforce inbound supply chain risk management by proposing a methodology, based on the analytic hierarchy process (AHP), for evaluating and ranking potential suppliers.
A realistic case study is presented in which a Portuguese industrial manufacturer evaluates and ranks its current foreign suppliers of stainless steel against two other potential foreign suppliers.

3 - Evaluating health-care waste disposal alternatives using analytical hierarchy process

Melis Almula Karadayi, Systems Eng., Yeditepe University, 34726, Istanbul, mkaradayi@yeditepe.edu.tr

Today, as in all other organizations, the amount of waste generated in the health-care institutions is rising due to their extent of service. Disposal of health-care waste management, including Turkey, is one of the most common problems of developing countries. This paper presents the application of analytical hierarchy process for evaluating health-care waste disposal alternatives for Istanbul, including "incineration', "steam sterilization ","microwave" and "landfill'. Economic, environmental, technical and social criteria and their related sub-criteria are employed to evaluate health-care waste dipsosal alternatives.

4 - An AHP model to evaluate brand equity of sports clubs

Mine Isik, Industrial Engineering Department, Dogus University, Zeamet S. No:21, Acibadem Kadikoy, 34722, Istanbul, -, Turkey, misik@dogus.edu.tr, *Ozay Ozaydin, Y. Ilker Topcu, Sebnem Burnaz*

Brand equity is defined as the sum of all values that is attributed to a brand, which makes it a crucial element while directly influencing the market value. If the mentioned brand belongs to a product, brand value can easily be attached to the qualifications of that product, but if it is a service, measurement of this value is more complex. Although there has been numerous studies on this topics, there is a gap in sports sector. In this study a comprehensive evaluation has been done, outputting the criteria. Then, a pairwise comparison is done in order to prioritize these criteria.

■ MD-13

Monday, 14:00-15:20
2.2.21

Discrete Location I

Stream: Location Analysis
Invited session

Chair: *Antonio Manuel Rodríguez-Chía*, Estadística e Investigación Operativa, Universidad de Cadiz, Facultad de Ciencias. Pol. Río San Pedro., 11510, Puerto Real, Cádiz, Spain, antonio.rodriguezchia@uca.es