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SELECTION OF ACADEMIC CONFERENCES BASED ON ANALYTICAL NETWORK PROCESSES

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Abstract

Academic conferences are platforms established by scientists to provide broad access to their research. For this reason, it is important to have influential researchers presenting plenary talks and for the scientific community in that field to submit their work. Various organizations and academic institutions organize hundreds of academic conferences a year. Academics have to select conferences to attend, since it is not possible to participate in every conference. Conference selection takes into account such factors as: the registration fee, subject of the conference and its appropriateness, conference language and the deadline for submission. We consider the specific criteria that academics use to choose conferences and effective decision-making in this field. In this study, we use an approach based on analytic network processes (ANPs) to appropriately choose a conference based on multiple criteria.

Keywords: Analytic Network Process (ANP), multicriteria decision making, selection of an academic conference.

1 Introduction

Academic conferences are events that present the work of academics and students (in the form of papers and posters). Their contribution is very important to academic study, due to the review process at the acceptance stage and feed-

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back when work is presented. Also, such conferences are important opportunities to work on specific issues and enable researchers in the same field to meet each other.

Academic conferences are organized for various purposes. Such meetings may be on specific topics, designed to be instructive and/or a forum for academics and students to interact in their research and learn new things.

Conferences are categorized as national or international. At such meetings, papers are presented, short or long-term training seminars and public meetings are held, as well as working groups being organized. The process of accepting papers for a conference and how academics select conferences have been studied in the literature. Yüncü and Kozak (2010) developed a scale based on the criteria which Turkish academics use to select a conference. They surveyed 1100 academics in Turkey from a large number of universities and the data from this survey were analyzed with the help of software packages. Factor analysis and confirmatory factor analysis were performed to determine the attractiveness of a congress or conference. The location of a congress was a very significant factor according to this study, the extent of the recreational opportunities available in the area were identified as having the greatest impact. At the same time, the variety of accommodation and accessibility of the location were also included, among other measures affecting preferences.

Kozak and Yüncü (2011) also conducted a study on the characteristics of conventions preferred by academics. The appropriate criteria are determined by a survey which included 40 factors, such as registration fee, the cost of accommodation, dates of the conference and possible contribution to career development. Confirmatory factor analysis and *t*-tests were used to analyze these data. According to the analysis of the data obtained, the following are the most significant factors when choosing a conference; opportunities for recreation, location of the congress and overall cost. Acar and Ünsal (2013) aimed to identify the factors influencing the choice of scientific and academic conferences and willingness to take part in e-congresses. Their research was based on a pilot study and interviews with a total of 150 academics from 4 faculties. The factors included were the subject of the congress, the prestige of the institution organizing the congress, the consistency between the theme of a congress and the research interests of an academic, as well as the natural and cultural charm of the conference location. Statistical analysis was performed to describe the demographics of the faculty members surveyed and the factors that influence their preferences.

The following studies have also appeared in the literature. Go and Zhang (1997) classified the factors that influence the location of a conference. Based on regression analysis, Chacko and Fenich (2000) conducted a study of selecting the location of a congress. Ngamsom and Beck (2000) analyzed participation in in-

ternational conferences and examined what influences the participants' motivation. Kim and Kim (2003) determined the significance of quality of service, accessibility etc. for selecting the site of a convention. Crouch and Louviere (2004) have developed various approaches and evaluated various alternatives for selecting the location of a congress. They also talked about the importance of competition from similar conferences. Chen (2006) used AHP to address the problem of congress selection. Lee and Back (2007) evaluated the factors influencing the submission process. Severt et al. (2007) explored a variety of factors determining participation in congresses and identified criteria like the appropriateness of conferences, training, opportunities for recreation, etc. Arslan et al. (2013) studied the level of academic support to students using a regression analysis based on data from Turkey. Dimitrios et al. (2014) investigated the best ways of increasing effectiveness when organizing conferences.

In this study, we aim to derive a rule for selecting conferences at national and international level according to the preferences of academics.

This study consists of 4 sections. In the second part, Analytic Network Processes are briefly described, together with a review of the literature. In the third part, we implement a decision rule, whose steps are described in detail. In the fourth part, we present the results of the study.

2 Analytic Network Processes

Analytic Network Processes (ANP) were developed by Saaty in 1980 as an extended version of analytic hierarchy processes. The ANP method derives a network describing the interaction of internally and externally dependent factors affecting a process. In this way, complex relationships that cannot be modeled using hierarchical structures can be modeled by ANP to aid in taking more effective decisions.

The ANP algorithm basically consists of 4 phases (Karabacak, 2012):

1. Determination of the interaction between the target and criteria.
2. Pairwise comparisons between the criteria and calculation of the eigenvalues of the corresponding matrix.
3. Forming super matrices.
4. Sorting and identifying the best alternative.

The application of the Analytic Network Process algorithm is illustrated in Figure 1.

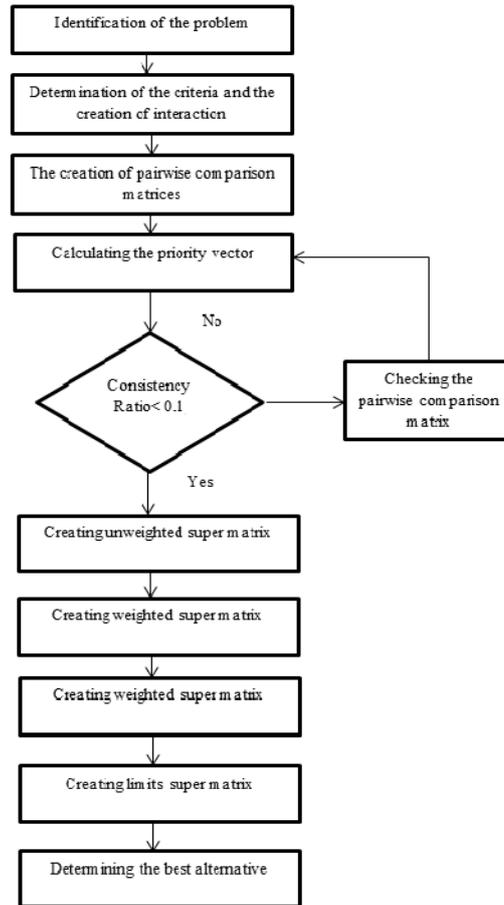


Figure 1. Algorithm for implementing ANP

The generated super-matrix shows the relationship between any pair of factors in the system. After the form of this matrix has been calculated, we derive the ranks of the alternatives and significance of the criteria, as shown in the flow chart above. Thus, the significant criteria and the ranking of alternatives are determined simultaneously.

The following studies have applied the ANP method: Lee and Kim (2000) and (2001), for example, chose a project for an information system using integrated ANP and goal programming. Meade and Presley (2002) used the ANP method for selecting research and development projects. Ravi et al. (2008) used ANP and goal programming methods for selecting reverse logistics projects. Büyüközkan and Öztürkcan (2010) evaluated six sigma projects using the ANP and Dematel methods. Cheng and Li (2005) used the ANP method for project se-

lection. Tripathy and Biswal (2007) used 0-1 goal programming methods for project selection. Wey and Wu (2007) used ANP and 0-1 integer goal programming methods for selecting projects in transportation systems. Begičević et al. (2010) used the ANP method for selecting projects at higher education institutions. Bağ et al. (2012) used ANP and goal programming for scheduling nurse care. Tavana et al. (2013) used such algorithms for selecting high-tech projects in NASA applications. El-Abbasy et al. (2013) used the ANP method for selecting projects for highway construction. Ivanovic et al. (2013) selected road transport projects using the ANP method. Görgülü et al. (2013) assessed investment projects using the ANP and TOPSIS methods. Macura et al. (2013) selected transportation projects for reconstructing a pedestrian street in a Balkan city using the ANP method. Wang et al. (2013) integrated ANP with a fuzzy DELPHI method for project selection. Ortiz et al. (2015) made an application based on the ANP and DEMATEL-ANP methods for selecting a six sigma project in health care. Grady et al. (2015) used the ANP method for selecting international development projects. Hamurcu et al. (2015) combined ANP and goal programming for shift scheduling. Tuzkaya and Yolver (2015) applied ANP to selecting research and development projects. Jeng and Huang (2015) combined the ANP and DEMATEL methods to select national research projects. Tavana et al. (2015) use TOPSIS and integer programming to select a project. Hamurcu et al. (2016a) integrated ANP with goal programming to select monorail projects in Ankara. At the same time, Özder and Eren (2016) used multicriteria decision making and goal programming to select a supplier. Hamurcu and Eren (2016b) used ANP-TOPSIS methods to select the route for a monorail and in another study (2016c) selected appropriate monorail technology using ANP.

3 A case study

In this study, selection criteria and the corresponding decision rule were derived to choose international and national conferences, using the ANP method. This process is implemented using a computer application. The first problem is to choose an appropriate conference from a set of six, based on their subjects, lengths and costs. In total 21 factors were chosen based on the literature review. The factors affecting the choice of the favored conferences were determined. Table 1 gives a description of the conferences available.

The conferences available are classified in Table 1 according to the subject and length of the conference and the registration fee. The subject of the conference is split into the following categories: general or very general, specialist and sub-branches. For example, natural science conferences are classified as very general, engineering as general, industrial engineering as specialist and the

scheduling of projects in industrial engineering as a sub-field. Academics made their choice by selecting the most appropriate conference according to their criteria from among these alternatives. The factors and sub-factors considered in this choice are presented in Table 2.

Table 1: Conferences available

Conference	Subject of the conference	Length of the conference (days)	Registration fee (TL)	Location of the conference	Conference language
A	General	2	300	İzmir	English/Turkish
B	Very General	2	750	İstanbul	English
C	Subfields	4	525	Antalya	English/Turkish
D	Very General	3	1200	Spain	English
E	General	3	800	Poland	English
F	Specialist	3	150	Aydın	Turkish

Table 2: Factors and sub-factors

Factor	Sub-Factor
Cost	Registration Fee
	Accommodation
	Transportation
Time	Travel Time
	Length of the Conference
	Submission Date
	Intensity of Conference
Conference	Subject of the Conference
	The Prestige of the Conference
	Conference Language
	Reputations of Main Speakers
	The Location of the Conference
	Academic Contribution of the Conference
	Social Programs
	Transport Facilities and Accessibility of Conference Venue
Country/City	Relevance
	Image of the Country/City
	Culinary Culture
	Safety
	Visa Facilitation
	Accommodation Facilities

In this study, choosing a conference was based on 4 factors and 21 sub-factors. The factors were split into cost, time, city/country and the conference itself. The cost sub-factors include all the components of costs incurred as a result of participating in a conference. These sub-factors are the registration fee, accommodation and transport costs.

Travel time, length of the conference, submission date and intensity (climate) of the conference are the sub-factors based on time. Travel time and length of the conference should not be long. The intensity (climate) of the conference is particularly affected by social activities and the submission date affects the ability of the participants to plan. City/country was another factor. It is important that the location is safe and has a wide range of accommodation. Culinary culture and the city/country's image are also among the relevant sub-factors.

The conferences themselves are described by several sub-factors, such as the conference location, transport facilities and accessibility. In addition, the subject of the conference, prestige of the conference and of its plenary speakers, language, relevance, social programs and academic contributions are also sub-factors. The conference should be located in an attractive city or region, easily accessible and close to major centers. Also, the social program is important, e.g. tours of the city or its natural surroundings. Participation in conferences is key in advancing one's academic career. Hence, it is important to select a conference that provides the maximum benefit to academics. Thus, the relevance of the conference, the conference language and reputation of the conference and its main speakers are important.

The literature and previous studies were used to determine the criteria that need to be satisfied in order to achieve the objectives of the application. Also, the views of scholars who participated in conferences and presented their academic work were taken into account. The ANP method was applied based on the factors and sub-factors defined above in order to measure the overall attractiveness of a conference and choose an appropriate conference. A network structure describing the interactions between these factors was derived. Sub-factors involving costs are associated with the following factors: Country/City, Conference and Time. Transportation costs are associated with the conference location, ease of obtaining a visa to visit the host country and the date of conference. Likewise, the views expressed by academic staff indicated an association between the subject of a conference and its academic importance. This network structure was derived using the SUPER DECISION program and is illustrated in Figure 2.

The structure of the ANP network, including the factors, sub-factors and alternatives, is shown in Figure 2. In addition, the mutual interactions between the factors are highlighted. This network is based on data from questionnaires answered by academics attending conferences. The 2nd stage of the ANP method involves calculating pairwise comparison matrices for the factors, sub-factors, alternatives and the characteristics of the alternatives. The matrices given by these binary comparisons were calculated based on Saaty's approach (1980) using a 1-9 scale and then their overall consistency was calculated. These comparisons were found to be consistent. The significance of the factors is assessed by

pairwise comparisons based on the experience and knowledge of the decision makers. These pairwise comparisons are used to define super matrices representing the relationship between pairs of factors in the system. Figure 3 shows the weights of the selection criteria obtained using pairwise comparison matrices.

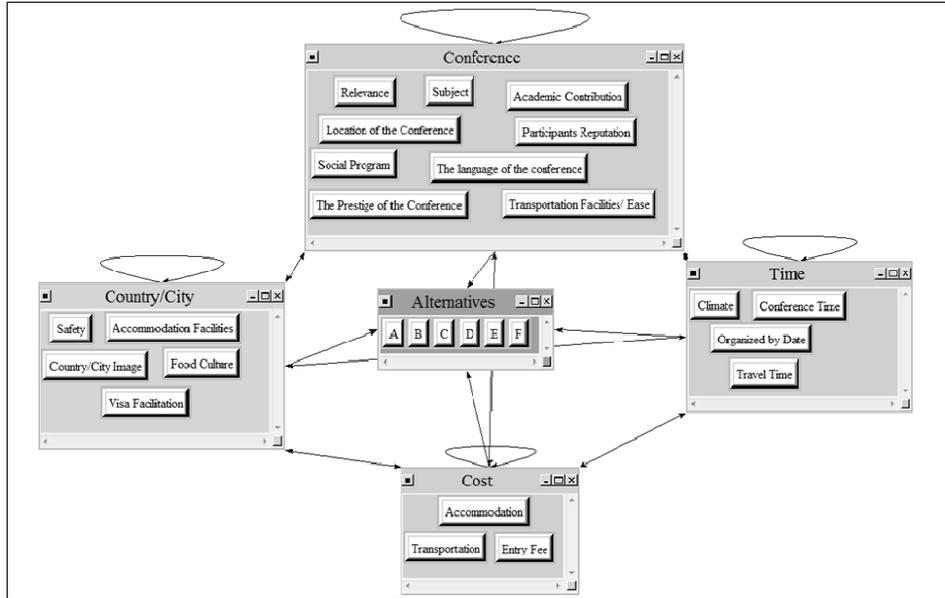


Figure 2. Structure of the ANP Network

The selection criteria are grouped into four separate groups: cost, time, country/city and the conference itself. According to these results, the subject of conference is the most important factor with a normalized weight of 0.117879. Travel costs are the second most important factor with a normalized weight of 0.107280. Academics rank the following factors most highly: “the subject of the conference”, “transport costs”, “image of country/city” and “academic contribution”. These criteria are considered to be very important when selecting one of six alternative conferences, which are evaluated as shown in Figure 4.

A network structure was derived to describe the relationship between these most significant factors and the remaining factors. By pairwise comparison of the results obtained, we obtain the following ranking of the alternatives: alternative F is in first place with value 0.218243, followed by alternative A with value 0.192537, alternative C with value 0.184145, alternative E with value 0.148414, alternative D with value 0.144356 and finally alternative B with value 0.112305.

No Icon	Academic Contribution		0.22399	0.089983
No Icon	Location of the Conference		0.09214	0.037015
No Icon	Participants Reputation		0.02189	0.008795
No Icon	Social Program		0.02818	0.011319
No Icon	Subject		0.29344	0.117879
No Icon	The Prestige of the Conference		0.04525	0.018179
No Icon	Transportation Facilities/Ease		0.18855	0.075745
No Icon	Relevance		0.09843	0.039542
No Icon	The language of the conference		0.00812	0.003262
No Icon	Accommodation		0.35328	0.071516
No Icon	Entry Fee		0.11678	0.023641
No Icon	Transportation		0.52994	0.107280
No Icon	Accommodation Facilities		0.14206	0.027627
No Icon	Country/City Image		0.48483	0.094289
No Icon	Food Culture		0.01552	0.003018
No Icon	Safety		0.29547	0.057462
No Icon	Visa Facilitation		0.06213	0.012082
No Icon	Climate		0.34994	0.036275
No Icon	Conference Time		0.34543	0.035807
No Icon	Organized by Date		0.17890	0.018545
No Icon	Travel Time		0.12573	0.013033

Figure 3. Weights of the sub-factors (normalized values in black)

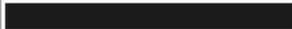
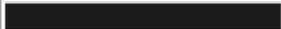
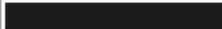
Name	Graphic	Ideals	Normals	Raw
A		0.882216	0.192537	0.018812
B		0.514586	0.112305	0.010973
C		0.843764	0.184145	0.017992
D		0.661447	0.144356	0.014104
E		0.680043	0.148414	0.014501
F		1.000000	0.218243	0.021323

Figure 4. Attractiveness of the alternatives

4 Results

Academic staff present the results of their research at conferences. Conferences are a platform for sharing knowledge and experience, thus providing significant benefits to those participating. Key experts in a field come together to present their work and interact with each other. There are many factors that influence the choice of a conference.

This study conducted research on the factors that influence the choice by academics of which conference to attend. The factors used in the study were chosen according to a literature review and questionnaires directed to academics. These factors were analyzed using the ANP method, which is then used to model a multicriteria decision problem. The most important factors in choosing a conference were the subject of the conference and travel costs.

Based on the answers given by academics, according to our analysis, there exist both internal and external interactions between the factors considered. These results were used to determine the most effective criteria for selecting a conference.

In this study, we have determined the criteria for selecting an appropriate conference for academics. A set of conferences were assessed using this approach. According to our analysis, academics look primarily at the subject of the conference and then other factors, such as cost, are taken into consideration.

References

- Acar S., Ünsal N.Ö. (2013), *Öğretim Üyelerinin Bilimsel Kongre Tercihinde Etkili Olan Unsurları Ve E-Kongre Hazırbulunuşluk Düzeylerini Belirlemeye Yönelik Bir Araştırma*, Süleyman Demirel Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, Vol. 1, 191-207.
- Arslan S., Çardak M., Uysal R. (2013), *Student Academic Support as Predictor of Academic Locus of Control in Turkish University Students*, Procedia-Social and Behavioral Sciences, 106, 2460-2469.
- Bağ N., Özdemir N.M., Eren T. (2012), *0-1 Hedef Programlama ve ANP Yöntemi ile Hemşire Çizelgeleme Problemi Çözümü*, International Journal of Engineering Research and Development, Vol. 4, No. 1, 2-6.
- Begičević N., Divjak B., Hunjak T. (2010), *Decision-Making on Prioritization of Projects in Higher Education Institutions Using the Analytic Network Process Approach*, Central European Journal of Operations Research, Vol. 18, No. 3, 341-364.
- Büyüközkan G., Öztürkcan D. (2010), *An Integrated Analytic Approach for Six Sigma Project Selection*, Expert Systems with Applications, Vol. 37, No. 8, 5835-5847.
- Chacko H.E., Fenich G.G. (2000), *Determining the Importance of US Convention Destination Attributes*, Journal of Vacation Marketing, 6(3), 211-220.
- Chen C.F. (2006), *Applying the Analytical Hierarchy Process (AHP) Approach to Convention Site Selection*, Journal of Travel Research, 45(2), 167-174.
- Cheng E.W., Li H. (2005), *Analytic Network Process Applied to Project Selection*, Journal of Construction Engineering and Management, Vol. 131, No. 4, 459-466.

- Crouch G.I., Louviere J.J. (2004), *The Determinants of Convention Site Selection: A Logistic Choice Model from Experimental Data*, Journal of Travel Research, 43(2), 118-130.
- Dinçel D. (2011), *Altı Sigma'da Proje Seçim Yöntemleri ve Bir Uygulama*, Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü, Yüksek Lisans Tezi.
- El-Abbasy M.S., Zayed T., Ahmed M., Alzraiee H., Abouhamad M. (2013), *Contractor Selection Model for Highway Projects Using Integrated Simulation and Analytic Network Process*, Journal of Construction Engineering and Management, Vol. 139, No. 7, 755-767.
- Go F., W. Zhang (1997), *Applying Importance-Performance Analysis to Beijing as an International Meeting Destination*, Journal of Travel Research, 35 (4), 42-49.
- Görgülü İ., Korkmaz M., Eren T. (2013), *Analytic Network Process and TOPSIS Methods with Selection of Optimal Investment Strategy*, Sigma, Vol. 31, 203-213.
- Grady C.A., He X., Peeta S. (2015), *Integrating Social Network Analysis with Analytic Network Process for International Development Project Selection*, Expert Systems with Applications, Vol. 42, No. 12, 5128-5138.
- Hamurcu M., Ünal F.M., Eren T. (2015), *The Solution of Shift Scheduling Problem by Using Analytic Network Process and Goal Programming Method*, The International Conference on Multiple Objective Programming, 17-19 December, Tlemcen, Algeria, 13-14.
- Hamurcu M., Gür Ş., Özder E.H., Eren T. (2016a), *A Multicriteria Decision Making for Monorail Projects with Analytic Network Process and 0-1 Goal Programming*, Proceedings of ISERD International Conference, 29 May, Istanbul, Turkey, 4-8.
- Hamurcu M., Eren T. (2016b), *Using ANP-TOPSIS Methods for Route Selection of Monorail in Ankara*, 28th European Conference on Operational Research, July 3-6, Poznan, Poland.
- Hamurcu M., Eren T., *Analitik Ağ Süreci İle Ankara'da Kentsel Ulaşım İçin Monoray Teknolojisinin Seçimi*, 3rd International Symposium on Railway Systems Engineering (ISERSE' 2016), 13-15 Ekim 2016c, Karabük, Türkiye.
- Ivanović I., Grujičić D., Macura D., Jović J., Bojović N. (2013), *One Approach for Road Transport Project Selection*, Transport Policy, Vol. 25, 22-29.
- Jeng D.J.F., Huang K.H. (2015), *Strategic Project Portfolio Selection for National Research Institutes*, Journal of Business Research, Vol. 68, No. 11, 2305-2311.
- Karabacak G. (2012), *Analitik Hiyerarşi Yöntemi ve Analitik Ağ Süreci İle Mühimmat Seçimi*, Atatürk Üniversitesi Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi.
- Khalili-Damghani K., Sadi-Nezhad S., Tavana M. (2013), *Solving multi-Period Project Selection Problems with Fuzzy Goal Programming Based on TOPSIS and a Fuzzy Preference Relation*, Information Sciences, Vol. 252, 42-61.
- Kim W.G., Kim H.C. (2003), *The Analysis of Seoul as an International Convention Destination*, Journal of Convention and Exhibition Management, 5 (2), 69-87.
- Kozak N., Yüncü K.D. (2011), *Akademisyenlerin Kongre Tercih Unsurları*, Anadolu Üniversitesi Sosyal Bilimler Dergisi, Vol. 11, No. 2, 19-32.
- Lee M.J., Back K.J. (2007), *Effects of Destination Image on Meeting Participation Intentions: Empirical Findings from a Professional Association and Its Annual Convention*, The Service Industries Journal, 27(1), 59-73.
- Lee J.W., Kim S.H. (2000), *Using Analytic Network Process and Goal Programming for Interdependent Information System Project Selection*, Computers & Operations Research, Vol. 27, No. 4, 367-382.
- Lee J.W., Kim S.H. (2001), *An Integrated Approach for Interdependent Information System Project Selection*, International Journal of Project Management, Vol. 19, No. 2, 111-118.
- Mukherjee K., Bera A. (1995), *Application of Goal Programming in Project Selection Decision – A Case Study from the Indian Coal Mining Industry*, European Journal of Operational Research, Vol. 82, No. 1, 18-25.

- Meade L.M., Presley A. (2002), *R&D Project Selection Using the Analytic Network Process*, Engineering Management, IEEE Transactions on, Vol. 49, No. 1, 59-66.
- Ngamsom B., Beck J. (2000), *A Pilot Study of Motivations, Inhibitors, and Facilitators of Association Members in Attending International Conferences*, Journal of Convention & Exhibition Management, Vol. 2, No. 2-3, June, 97-111, Taylor & Francis Group.
- Onursal B. (2009), *Proje Seçiminde Bulanık TOPSIS Yöntemi ile Bir Model Önerisi: İnşaat Sektörü Uygulaması*, İstanbul Teknik Üniversitesi Fen Bilimleri Enstitüsü, Doktora Tezi.
- Ortiz M.A., Felizzola H.A., Isaza S.N. (2015), *A Contrast between DEMATEL-ANP and ANP Methods for Six Sigma Project Selection: A Case Study in Healthcare Industry*, BMC Medical Informatics and Decision Making, Vol. 15, No. 3.
- Özder E., Eren T. (2016), *Çok Ölçütlü Karar Verme Yöntemi Ve Hedef Programlama Teknikleri İle Tedarikçi Seçimi*, Selçuk Üniversitesi Mühendislik, Bilim ve Teknoloji Dergisi, 4(3), 196-207.
- Ravi V., Shankar R., Tiwari M.K. (2008), *Selection of a Reverse Logistics Project for End-of-Life Computers: ANP and Goal Programming Approach*, International Journal of Production Research, Vol. 46, No. 17, 4849-4870.
- Saaty T.L. (1980), *The Analytic Hierarchy Process*, McGraw-Hill, New York.
- Severt D., Wang Y., Chen P.-J., Breiter D. (2007), *Examining the Motivation, Perceived Performance and Behavioral Intentions of Convention Attendees: Evidence from a Regional Conference*, Tourism Management, 28, 399-408.
- Tavana M., Keramatpour M., Santos-Arteaga F.J., Ghorbaniane E. (2015), *A Fuzzy Hybrid Project Portfolio Selection Method Using Data Envelopment Analysis, TOPSIS and Integer Programming*, Expert Systems with Applications, Vol. 42, No. 22, 8432-8444.
- Tripathy B.B., Biswal M.P. (2007), *A Zero-One Goal Programming Approach for Project Selection*, Journal of Information and Optimization Sciences, Vol. 28, No. 4, 619-626.
- Tuzkaya U.R., Yolver E. (2015), *R&D Project Selection by Integrated Grey Analytic Network Process and Grey Relational Analysis: An Implementation for Home Appliances Company*, Journal of Aeronautics and Space Technologies, Vol. 8, No. 2, 35-41.
- Wang W.M., Lee A.H., Peng L.P., Wu Z.L. (2013), *An Integrated Decision Making Model for District Revitalization and Regeneration Project Selection*, Decision Support Systems, Vol. 54, No. 2, 1092-1103.
- Wey W.M., Wu K.Y. (2007), *Using ANP Priorities with Goal Programming in Resource Allocation in Transportation*, Mathematical and Computer Modeling, Vol. 46, No. 7, 985-1000.
- Yüncü D., Kozak N. (2010), *Türk akademisyenlerin kongre tercihleri üzerine bir araştırma*, Anatolia: Turizm Araştırmaları Dergisi, Vol. 21, No. 1, 109-120.