Fen Bilimleri Dergisi, 23(4) (2011) 140-159.
Marmara Üniversitesi

Review/Derleme

Studies on fuzzy decision making in Turkish Universities: An overview

Aykut KENTLI*

Department of Mechanical Engineering, Marmara University, Göztepe Campus, Istanbul, Turkey 34772, Tel: +90-216-4182357 / 1208 Fax: +90-216-3480293
Email: akentli@marmara.edu.tr

Abstract

Fuzzy sets theory bridges the gap between boolean logic and human logic which is including a high degree of ambiguity. It has been used to accomplish different tasks (to control, to optimize, to make decision etc.) in different areas (education, management, medicine, technical, military etc.). Many fuzzy decision making methods have been proposed over the years. Classification of these methods and their applications can be found in literature. However, most of these studies concern only one method or one specific application area or one certain time interval. From this point of view, this study aims to show the studies on application of fuzzy decision making in Turkish universities. It is expected that this study will help the researchers on working fuzzy decision making as it is beneficial to know the previous studies on their topic, in an organized way and there is no similar study on this area. It mainly surveys the PhD and MSc Theses in Turkey on fuzzy decision making and the unclassified studies are not given to limit the study. Classified studies are summarized, compared and future recommendations are given for new researchers.

Keywords: Fuzzy Decision Making, Review Paper

1. Introduction

The ability to make rational decisions is one of the mankind's unique attributes. Man has continuously devised ways and means to enlarge his abilities to cope with the growing complexity of his decision problems. A characteristic of most of the formal techniques that have been used for decision making is the selection of the best alternative with respect to a certain figure of merit. However, the nature of many decision problems has changed considerably in recent years, and serious doubts have been raised as to the adequacy of many models and their solution techniques. Having uncertainty in parameters and having several factors affecting decision maker led to fuzziness and multiplicity in decision making situations (Tabucanon, 1988).

It is not surprising to see that uncertainty always exists in the human world. Research that attempts to model uncertainty in to decision analysis is done basically through probability theory and/or fuzzy set theory. The former presents the stochastic nature of decision analysis while the latter captures the subjectivity of human behaviour. It is suggested by Efstathiou (1979) and Dubois and Prade (1985) that a stochastic decision method such as statistical decision analysis does not measure the imprecision in human behaviour; rather, this method is a way to model incomplete knowledge about the external environment surrounding human

*Sorumlu yazar: Aykut KENTLI, akentli@marmara.edu.tr

beings. Fuzzy set theory, on the other hand, is a perfect means for modeling uncertainty (or imprecision) arising from mental phenomena which are neither random nor stochastic. Human beings are heavily involved in the process of decision analysis. A rational approach toward decision making should take into account human subjectivity, rather than employing only objective probability measures. This attitude towards the uncertainty of human behaviour led to study on fuzzy decision making (Chen and Hwang, 1992).

Pioneering study on fuzzy logic is done by Lotfi Zadeh (1965). The first attempt at applying fuzzy set theory to multi-attribute analysis is done by Bellman and Zadeh (1970), who have outlined one possible route toward fuzzy decision making. Due to the easiness and variety of fuzzy logic applications, studies on this area are quickly spread out. Today, fuzzy logic hasn't lost its value yet. Each year, thousands of studies are carried out on this field over the world. Turkey also produces its share from these studies. However, there are few or no studies on some areas while studies on the other areas have been increasing because variety of the studies' contents and application areas has not been investigated. Kentli (2011) has classified the studies on fuzzy logic application but only to control of electrical machines. This study investigates the application areas of fuzzy decision making to fill this gap.

The scope of this study is narrowed to be able to investigate thoroughly due to extensiveness of the application area. Only the studies on fuzzy decision making applications are investigated. In this study, firstly, background information on fuzzy logic and decision making are given. Then, studies in Turkish Universities are summarized and compared. Lastly, recommendations for future studies are given.

2. Background on fuzzy logic

The development of technology has computerized our life and strengthened the problem of man–machine interaction. The man-machine interaction could be understood in a wide sense, not just as an interface but as a problem of establishing a harmony in communication between a computer and a human being on the levels of cooperative thinking, logic and language. We have a computer, operating according to Boolean logic with numerical mathematical models constructed by application researchers, and users who operate with another sort of logic and language including a high degree of ambiguity or fuzziness. Fuzzy set theory aims to bridge this gap.

Over the past few decades, the use of fuzzy set theory, or fuzzy logic, in control systems has gained widespread popularity, especially in Japan. From as early as the mid-1970s, Japanese scientists have been instrumental in transforming the theory of fuzzy logic into a technological realization. Today, fuzzy logic-based control systems, or simply fuzzy logic controllers (FLCs), can be found in a growing number of products, from washing machines to speedboats, from air condition units to hand-held autofocus cameras.

The inference engine is the heart of a fuzzy controller (and any fuzzy rules system) operation. Its actual operation can be divided into three steps (Figure 1):

- Fuzzification – actual inputs are fuzzified and fuzzy inputs are obtained.
- Fuzzy processing – processing fuzzy inputs according to the rules set and producing fuzzy outputs.
- Defuzzification – producing a crisp real value for a fuzzy output.

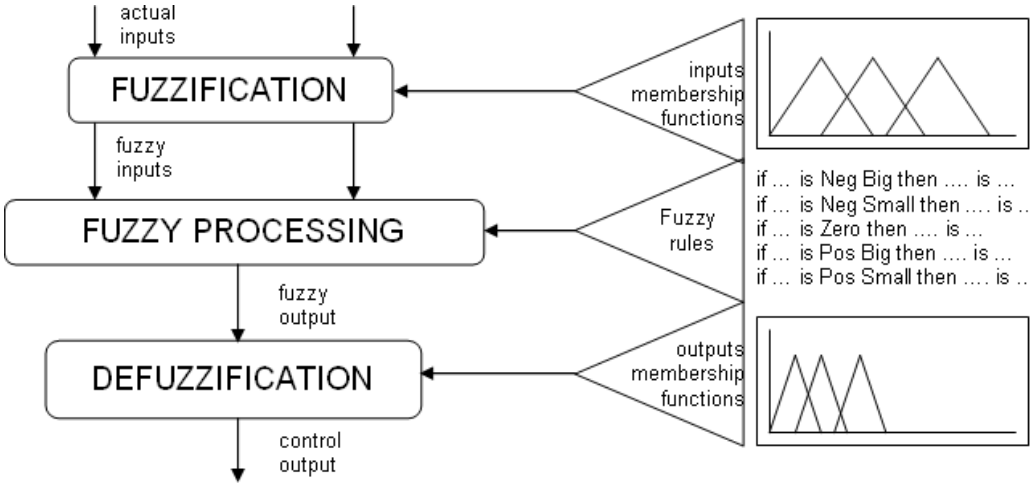

Figure 1. Operation of a fuzzy controller (Reznik, 1997)

3. Decision Making Theories

Making decisions is a part of our daily lives. The major concern is that almost all decision problems have multiple, usually conflicting criteria. Research on how to solve such problems has been enormous. Methodologies, as well as their applications, appear in professional journals of different disciplines. Diversified as such problems may be, they are broadly classified into two categories: MADM and MODM. From a practical viewpoint, MADM is associated with problems whose number of alternatives has been predetermined. The Decision Maker (DM) is to select/prioritize/rank a finite number of courses action. On the other hand, MODM is not associated with problems in which alternatives have been predetermined. The DM's primary concern is to design a "most" promising alternative with respect to limited resources.

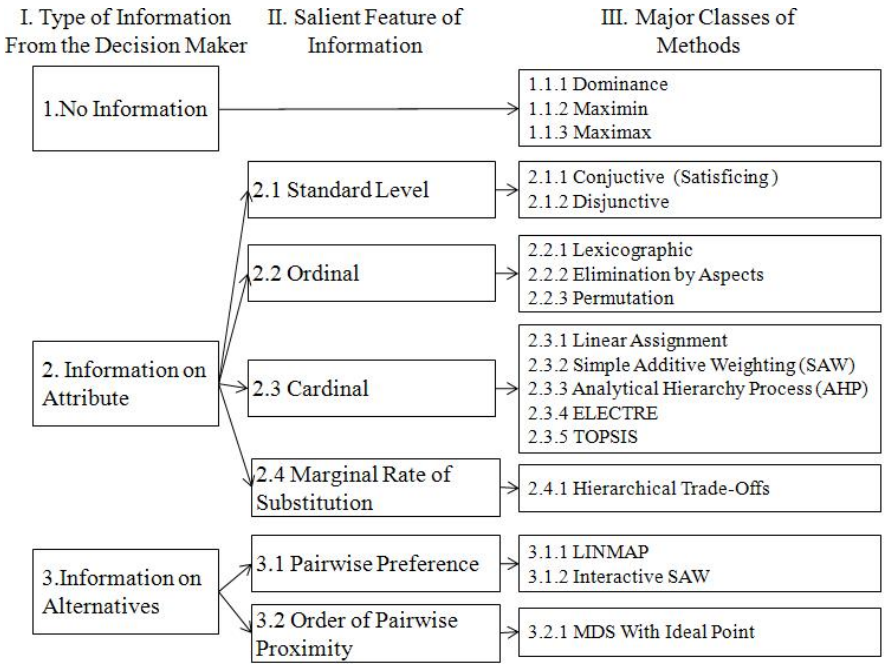

Figure 2. Classification of MADM (Hwang & Yoon, 1981)

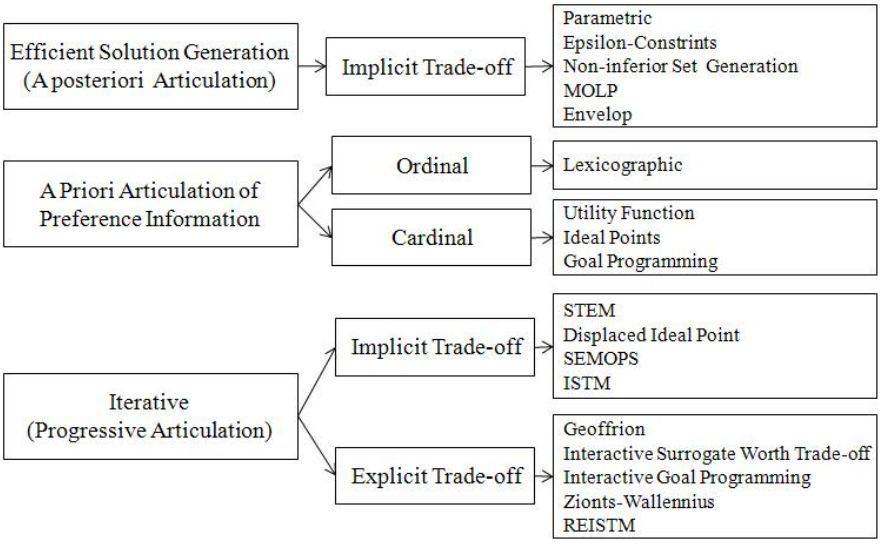

Figure 3. Classification of MODM (Sen & Yang, 1998)

Methods and applications of MADM and MODM regarding a single decision maker have been thoroughly and critically reviewed and systematically classified by Hwang and Yoon (1981) and Evans (1984), respectively. They based their grouping of techniques according to the stage at which information from the decision maker is needed by the analyst. The classification of MADM (Figure 2) and MODM (Figure 3) is divided into considering articulation of preference information. Detailed explanation on methods given in figures can be found at Hwang and Yoon (1981), Sen and Yang (1998).

4. Studies on Fuzzy Decision Making

This work has aimed to reveal the extent of studies in Turkish Universities done on fuzzy decision making. Scope of the study is limited to MSc and PhD theses. In this section, summarized explanations of the studies are given in order according to their application area. Most of the application areas are diversified as Education, Management, Medicine, Military and Technical. The unclassified studies are given under the topic: Others.

4.1.Education

Baysal (2005) has evaluated the efficiency of Higher Education System in Turkey. Kaptanoğlu (2005) has evaluated the academic performance. Türker (2007) has identified the students' attitude towards mathematics education courses. Gültaş (2007) used fuzzy AHP to construct the syllabuses of mathematics courses in the industrial engineering education. Erümit (2007) used fuzzy AHP to select MSc students. Kınay (2008) has formed student groups considering various objectives by using fuzzy decision making. Göksu (2008) applied fuzzy AHP to university preference ranking. Oruç (2008) applied fuzzy data envelopment analysis to measure efficiency at universities. Çakıt (2008) has determined the factors affecting hand dexterity. Bakanay (2009) has evaluated the performance of micro teaching. Arı (2009) has used fuzzy decision making in vocational guidance. Özdemir (2009) has determined the effect of learning environment based learning styles to students' achievement and attitude. Armağan (2008) has evaluated students' academic performance. Uzun (2008) has applied a fuzzy expert system approach to guide the students for programs in vocational technical schools. Four main criteria (abilities, interests, values and academic achievement)

and thirty five sub criteria are determined and a model of guidance to field in vocational technical schools is developed in this study.

4.2.Management

Applications in this section can be grouped on Supplier Selection, Risk Analysis, Personnel Selection, Location Selection and Portfolio Analysis. Unclassified applications are given at the following paragraph.

Tiryaki (1998) has applied fuzzy Bayesian decision making to a production problem. Küçümen (1999) used a decision support system for scheduling of a software project. Gözen (2001) evaluated the corporate value in business. Baltacıoğlu (2004) has determined inventory lot sizes using fuzzy wagner whitin algorithm. Kıyak (2005) has applied to calculate life time for life insurance. Okul (2007) implemented quality function deployment to furniture sector using analytic network process and fuzzy decision making, together. Ekici (2007) has determined optimum pricing strategy for a telecommunications service by using fuzzy extended AHP. Mete (2007) applied to maintenance management. Alioğlu (2006) has evaluated the performance in municipalities. Kaya (2006) has predicted inflation for different economic actors. Özdağoğlu (2008) used fuzzy analytic network process. Efendigil (2008) has formed a customer oriented system using an artificial neural network and fuzzy inference based decision support system. Öztürk (2008) has improved the purchase process of a state hospital. Ulubeyli (2008) used fuzzy multiple criteria decision making model for subcontractor selection in international construction projects. Çakır (2009) has selected a third party logistics service provider (3PL) via fuzzy AHP. Yel (2009) has applied fuzzy decision making to logistic sector. Mızrak (2009) has developed customer tailored products via fuzzy decision making. Görkemli (2009) has managed reliability analysis of a production process. Erkut (2008) has used fuzzy AHP in selection of customer oriented strategies for a company. Akçay (2008) has applied fuzzy decision making to a public tendering decision support model according to European confirmation criteria. Kuzgunkaya (2000) has selected a flexible manufacturing system using multicriteria 0-1 programming and fuzzy decision making. Ertuğ (2009) has determined the effective sale price. Türkoğulları (2004) has selected an information system project. Akgül (2001) used fuzzy decision making to predict the demand.

4.2.1. Supplier Selection

Bayrak (2004) has selected supplier using fuzzy decision making. Güner (2005) has selected supplier using fuzzy AHP. Durdudiler (2006) has evaluated performance of a supplier using fuzzy AHP. Önal (2006) has selected a supplier for a washing machine company using fuzzy AHP. Özel (2007) used fuzzy axiomatic design approach to select supplier. Karaarslan (2008) has analyzed supplier capability in manufacturing industry. Göktürk (2008) has evaluated supplier performance by using fuzzy AHP. Genç (2009) has applied intuitionistic fuzzy preference relations to supplier selection. Aslan (2009) has selected supplier using fuzzy AHP. Sağlam (2008) has analyzed the effect of sales and distribution function performance over supply chain performance in supply chain management. Akyüz (2005) used fuzzy Data Envelopment Analysis (DEA) to select supplier.

4.2.2. Risk Analysis

Fazlıoğulları (2003) has calculated the life cycle cost of a computer classroom project. Tüysüz (2004) used fuzzy AHP to analysis the risk of a project. Semercioğlu (2005) has performed a fuzzy risk analysis on a major end item project. Han (2005) has estimated cost overrun risk in

international projects. Ünlüyıldız (2007) has evaluated the risk of an ERP implementation project using fuzzy extended AHP. Gürkanlı (2006) has analyzed the risk for occupational safety in construction sites. Kuşan (2009) has evaluated the risks in construction projects. Karabay (1997) has analyzed political risk for international construction sector.

4.2.3. Personnel Selection

Engelkıran (2001) has applied multiple criteria decision making to human resource management. Kahya (2003) has evaluated the job application forms in the selection of human power. Tekin (2004) has selected project teams using fuzzy synthetic evaluation. Serhadlıoğlu (2005) has selected personnel using fuzzy-AHP and ELECTRE III methodologies. Ballı (2005) selected players in basketball. Ecer (2007) has assessed the candidates in human resource selection with fuzzy TOPSIS. Kankılıç (2005) has developed a fuzzy decision making model for personnel selection. Boran (2009) has applied intuitionistic fuzzy set on personnel selection. Aksakal (2009) has applied fuzzy axiomatic design method for personnel selection problem. Demirdağ (2000) has evaluated performance of personnel and selected a candidate.

4.2.4. Location Selection

Ercan (2006) has evaluated the locational suitability of settlements in Odunpazarı, Eskişehir. Ahlatçıoğlu (2005) has selected the location of a facility. Kodalak (2009) has selected the location of the gas station using geographic information systems and fuzzy analytical network process approach. Cengiz (2007) has used fuzzy analytic network to select the location of a dock.

4.2.5. Portfolio Analysis

Canaslan (1996) has used fuzzy decision making to calculate of premiums. Satı (2000) has evaluated the transportation investments. Canbol (2002) has compared fuzzy linguistic approach with analytic hierarchy process in selecting quality-based investments. Atalan (2003) has applied fuzzy decision making to capital budgeting. Yıldız (2003) has evaluated CIM investments using fuzzy AHP method. Küçük (2004) has decided which investment is suitable under uncertainty. Çatinsaya (2004) has applied fuzzy decision making methods in optimization of multiple criteria resource allocation problems. Ahlatçıoğlu (2005) has selected the suitable portfolio. Taş (2005) has used fuzzy approach to credit construction firms. Özdemir (2009) has managed fuzzy-multi objective evaluation of tourism investments. Baş (1995) has modelled an expert system to calculate stock composite index. Bilsel (2005) has worked on portfolio management.

4.3.Medicine

Beyan (2005) has used a new fuzzy-chaotic modelling proposal for medical diagnostic processes. Muşdal (2007) has selected a medical waste operation and eliminate technology using fuzzy AHP and fuzzy analytical network process. Barışçı (2000) has applied FFT method to cardiac doppler signals and utilized of results with fuzzy decision making. Torun (2007) has designed a hierarchical fuzzy expert system for diagnosis and therapy of coronary heart disease risk.

4.4. Military

Tekeş (2002) has compared the pistols used in Turkish Army Forces by AHP with fuzzy suitability index. Adalı (2003) applied fuzzy decision making to technological intelligence,

innovation, design and competitive strategies in defense industry. Akbay (2004) has built a fuzzy expert system to evaluate the proficiency of military personnel in units. Çakır (2004) has measured weapon effectiveness. İpek (2004) has formed a vehicle buying decision support systems for The Headquarters of the Gendarmerie General Command. Yakut (2004) has selected the most useful ship for Turkish Naval Forces. Bali (2004) has selected the instructors at the Turkish Military Academy by using fuzzy AHP. Afacan (2005) has located the fault in shipboard power distribution system. Kaplan (2007) has evaluated equipment investment projects in air defence sector by fuzzy AHP. Çolpan (2008) has measured the performance and evaluated 2nd Air Supply and Maintenance Center Command production jobshops. Çakır (2001) has selected the main battle tank using fuzzy AHP. Kahraman (2000) has selected the best weapon system in Turkish army by fuzzy analytic hierarchy process. Artuç (2001) has evaluated the performance of military radio systems.

4.5. Technical

Tan (1997) has predicted short term system load using fuzzy neural networks. Yılmaz (1999) has selected cutting parameters. Boyacı (1994) has selected the nuclear power plant site. Menteş (2000) has selected manevouring and propulsion system. Ölçer (2001) has developed a new fuzzy multiple attribute decision making approach and its application to decision making in ship design and shipbuilding. Karaköse (2001) has estimated the physical parameters of electric motors. İlkaz (2002) has determined the cutting condition for CNC turning operations. Aksoy (2003) has applied fuzzy decision making in civil engineering. Tortum (2003) has modelled mode choices of intercity freight transportation with artificial neural networks and an integrated neuro-fuzzy system. Gürbüz (2003) has determined the slurry quality in ceramics production. Yanar (2003) has enhanced cell-based GIS analyses using fuzzy decision making. Aydın (2004) has selected cable materials. Taşdemir (2004) has designed a fuzzy expert system for definition of gasoline engines performance and emission characteristics. Çelik (2004) has evaluated the systems of seed distribution smootlines in pneumatic sowing machine. Boz (2005) has detected the outliers in GPS observation. Yılmaz (2006) has applied AHP and fuzzy AHP to aircraft selection criteria. Özkan (2006) has predicted cutting forces and tool tip temperature in turning using fuzzy decision making and ANN techniques. Çavuş (2004) has evaluated liquefaction potential of soils due to earthquake. Akpınar (2005) has selected software for a liner shipping company. Doğan (2006) has estimated asphalt concrete distresses on national highways. Riaz (2005) has selected precise method for seepage measurements and the most suitable material for canal lining. Karahan (2007) has written software predicting upper level icing potential. Kop (2007) has managed fuzzy multi-criteria decision making in solid waste collection system in Turkey. Yalçın (2007) has selected the layout of wind energy station by using fuzzy AHP. Mikail (2007) has designed a fuzzy expert system for reclamation of saline soils. Alkan (2007) has evaluated Adana cement raw material field by geostatistics and fuzzy approaches. Öz (2007) has selected cargo helicopter. Turgay (1997) has built an expert system for continue production. Tosunoğlu (2007) has predicted crustal motion velocities which are constitute earthquake by the fuzzy adaptive network in spatial statistics. Oranlı (2007) has selected radio frequency identification technology using fuzzy AHP. Dursun (2007) has evaluated solid waste management scenarios. Akbıyık (2008) has modelled the emissions of a diesel engine using hydrogen fuel by a fuzzy expert system. Gürün (2008) has estimated the parameters in deep drawing dies. Erdinç (2008) has modelled and analyzed fuel cell/ultra-capacitor hybrid vehicular system using wavelet transform/fuzzy decision making based energy management strategy. Kavraal (2009) has determined starter motors fault use for fuel-injection engine motors. Aliustaoğlu (2008) has managed the real time analysis and diagnosis of bearing

faults. Güleç (1996) has evaluated the performance of manufacturing industry. Kahraman (1996) has analyzed advanced manufacturing technologies economically.

4.6. Others

Sarıbık (1995) has formed a fuzzy expert system shell prototype. Küçüköncü (1996) has managed a critical survey of fuzzy logic as a basis for approximate reasoning. Çolak (1997) has investigated and simulated of new inference algorithms for fuzzy rule based system. Karanfil (1997) has developed a method for constructing a membership function by using experimental data in fuzzy logic problems. Özkan (1998) has worked on approximate reasoning in fuzzy logic and application to a problem. Öztürk (1999) has studied fuzzy decision making. Yürekli (1999) has worked on fuzzy expert systems. Sıkıcı (2000) has managed a fuzzy logic based expert system shell. Yonar (1999) has formed a general purpose fuzzy expert system. Mert (2003) has worked on the aggregation problem of fuzzy information and using them in decision making models. Kabak (2003) has used a fuzzy multiple attribute decision making approach to evaluate the position of Turkey in sustainable development. Demircan (2004) has worked on fuzzy replacement analysis. İphar (2004) has applied fuzzy sets to diggability classification systems for determining ripper type. Altuntaş (2004) has worked on artificial intelligence algorithms and fuzzy set based expert system approach in facility design. Dilsiz (2005) has formed Turkish spell checker and correction using fuzzy decision making and artificial neural networks. Alkan (2006) has managed linguistic comparison using fuzzy decision making in analitic hierarchy process. Altunal (2006) has performed a research on fuzzy data envelopment analysis. Deniz (2006) has used fuzzy decision making in forecasting. Şentürk (2006) has used fuzzy decision making approach in experimental design. Çitli (2006) has worked on fuzzy multi criteria decision making. Üzgün (2006) has worked on fuzzy analytical hierarchy process. Günay (2006) has worked on aggregation operators in fuzzy decision making. Güneş (2006) has worked on fuzzy data envelopment analysis. Bilgin (2006) has worked on fuzzy failure mode and effect analysis. Kuşçu (2007) used fuzzy logic approach in decision making processes. Aydemir (2008) has evaluated urban life quality in Zeytinburnu. Gökdalay (2008) has analyzed the performance of an airport. Karakaşoğlu (2008) has worked on fuzzy multi-criteria decision making methods. Topel (2006) has worked on the applications of fuzzy AHP. Afşar (2008) has estimated pan evaporation using artificial neural networks and fuzzy decision making. Yolcu (2008) has worked on high order fuzzy time series forecasting model based on artificial neural networks. İnan (2008) has evaluated the performance of quality management systems by using fuzzy AHP and fuzzy analitical network process. İşcan (2009) has worked on application of fuzzy decision making in land consolidation activities. Budayan (2008) has worked on strategic group analysis. Başkömürcü (1995) has used fuzzy decision making in forecasting. Bilen (1997) has worked on neuro-fuzzy network models for wle-bsed systems. Işıklar (2003) has evaluated the electronic payment alternatives. Özkök (2005) has used neural network and neurofuzzy models in web based ionospheric forecasting.

5. Observations

There are 936 studies on fuzzy logic in Turkish universities. Among them, 176 studies are on fuzzy decision making (Figure 4). Figure 5 shows the studied areas in detail.

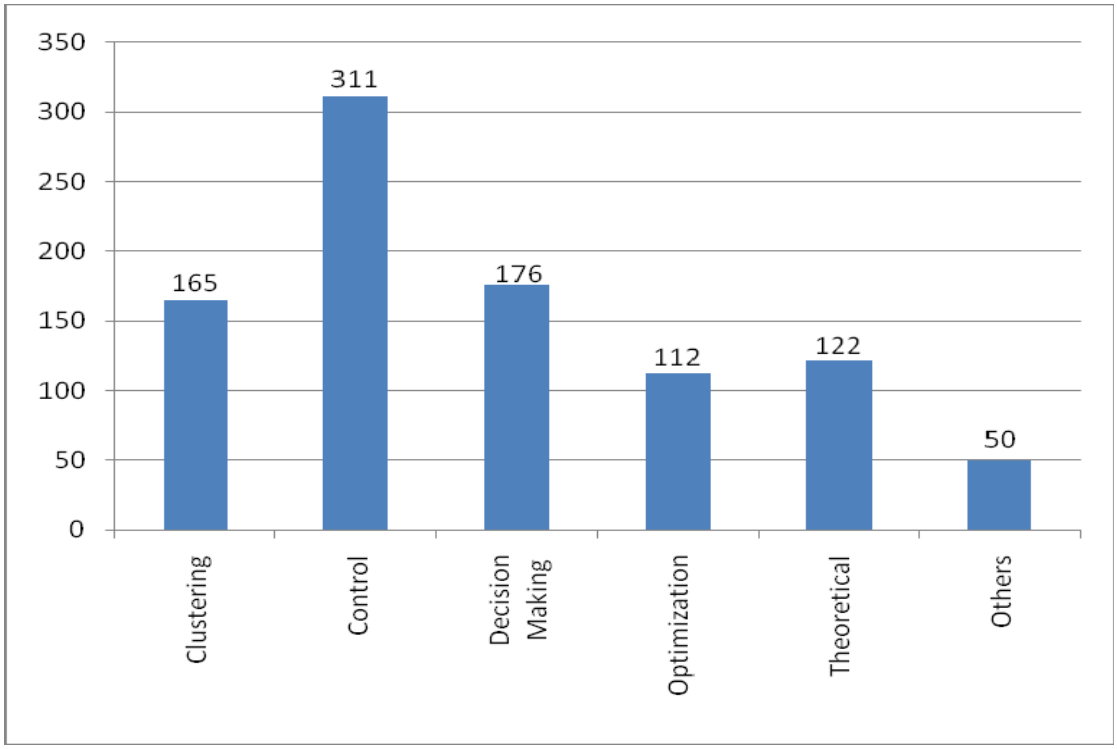

Figure 4. Number of fuzzy logic applications in Turkish Universities

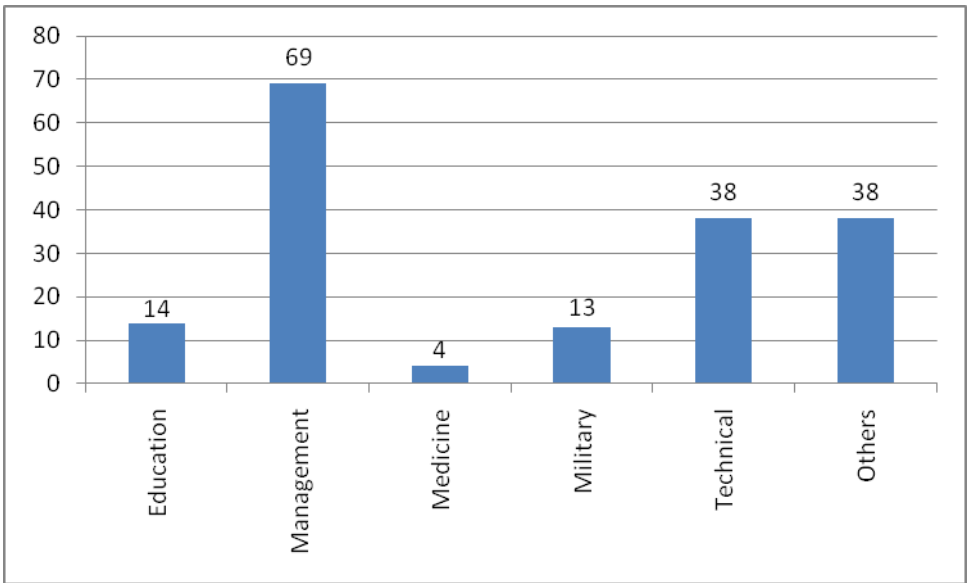

Figure 5. Number of studies in each application area

On the other hand, investigated studies are completed in a 16 year time interval. Studies on fuzzy decision making in Turkey have begun at 1994. It is rather late when the history of fuzzy decision making is concerned. However, during last decade, studies are doubled according to the previous decade (Figure 6).

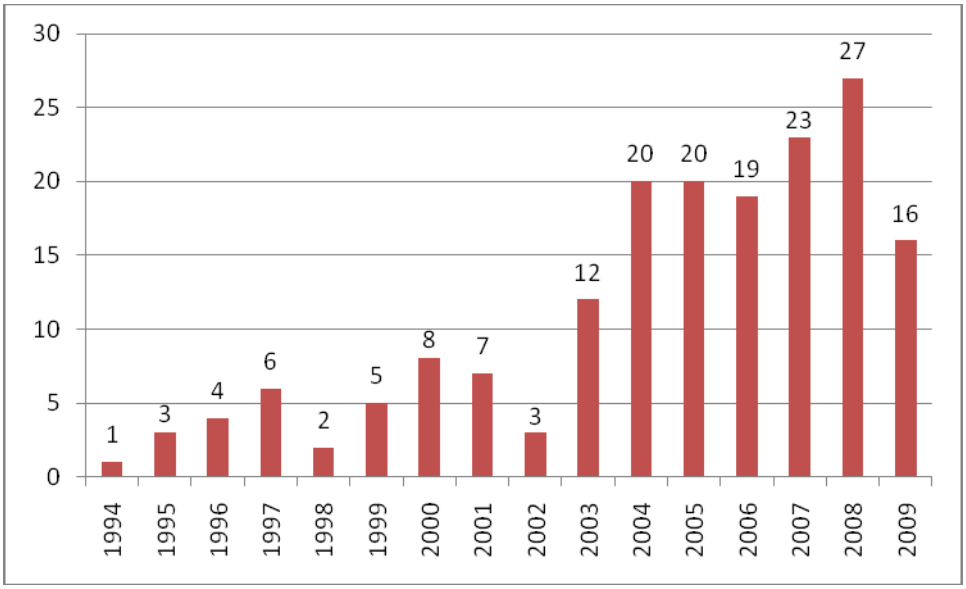

Figure 6. Number of studies over the years

139 studies are MSc theses and 37 studies are PhD theses. Number of PhD theses is more than quarter of that of MSc theses. It is seen that some of these theses are converted into a scientific article (48 of them) or a proceeding (22 of them). 90 articles are published in SCIE indexed journals and 29 articles are published in several journals in different indexes. Also, 89 proceedings are presented in different conferences. In fact, there is more contribution (over 400 articles) to literature when searched for fuzzy decision making. More than half of these studies (260 of 454 articles) are cited at least one time (some of them are cited more than 100 times). Table 1 shows the authors from Turkey and the number of their articles found in literature. The first eleven authors in Table 1 have written the half of all studies.

Table 1. Author name and number of published articles and proceedings

KAHRAMAN, C (68)	ER, ID (6)	CICEK, K (4)	ARSLAN, T (3)	ULUKAN, HZ (3)
BUYUKOZKAN, G (40)	GENEVOIS, ME (6)	DEMIREL, T (4)	ATES, NY (3)	YAZICI, A (3)
KARSAK, EE (22)	KARA, SS (6)	GURBUZ, T (4)	AYDIN, O (3)	ZAIM, S (3)
CEBI, S (21)	KAYA, T (6)	IC, YT (4)	BAGRIYANIK, M (3)	AHLATCIOGLU, M (2)
KAYA, I (20)	TOLGA, E (6)	KARA, S (4)	BASCETIN, A (3)	AKDEMIR, B (2)
CELIK, M (19)	TUZKAYA, UR (6)	KOP, Y (4)	BEREKETLI, I (3)	ARSLAN, G (2)
FEYZIOGLU, O (17)	AKAY, D (5)	KULAK, O (4)	BORAN, FE (3)	ARSLAN, H (2)
GUNES, S (12)	EFENDIGIL, T (5)	OZEN, A (4)	CIFTCIBASI, T (3)	ATAGUN, AO (2)
POLAT, K (12)	ERENSAL, YC (5)	SEN, CG (4)	CIVICIOGLU, P (3)	BAYKASOGLU, A (2)
GUNGOR, Z (10)	GULER, I (5)	SEVKLI, M (4)	DEMIREL, NC (3)	BESDOK, E (2)
ONUT, S (10)	GUNERI, AF (5)	SOYSAL, B (4)	ERASLAN, E (3)	BORAN, S (2)
ARIKAN, F (8)	KURT, M (5)	TUR, R (4)	GULBAY, M (3)	BOZDAG, CE (2)
AYAG, Z (8)	OZKARAHAN, I (5)	TUZKAYA, G (4)	GULSUN, B (3)	CAYIRCI, E (2)
ERTUGRUL, I (8)	SELIM, H (5)	YARDIMCI, A (4)	GUNES, M (3)	CEKEN, C (2)
ALBAYRAK, YE (7)	SENER, Z (5)	YUKSEL, I (4)	GUVEN, A (3)	CELIKYILMAZ, A (2)
DAGDEVIREN, M (7)	TIRYAKI, F (5)	YURDAKUL, M (4)	KABAK, O (3)	CEVIK, S (2)
ERTAY, T (7)	TURKSEN, IB (5)	ALTAS, IH (3)	KARAKASOGLU, N (3)	CEYLAN, R (2)
OZDEMIR, RG (7)	ALPTEKIN, SE (4)	ARAZ, C (3)	KILIC, YA (3)	CIFCI, G (2)
TOLGA, AC (7)	BESKESE, A (4)	ARSENYAN, J (3)	OZGEN, D (3)	CINAR, D (2)
UBEYLI, ED (7)	CEBECI, U (4)			

There are 95 state and 34 private universities and 5 military institutions in Turkey. Investigated studies are done at 32 state universities (Figure 7). Approximately half of studies are done at 4 universities (Istanbul Technical University, Yıldız Technical University, Gazi University and Galatasaray University). Most of the studies are written in Turkish (Figure 8).

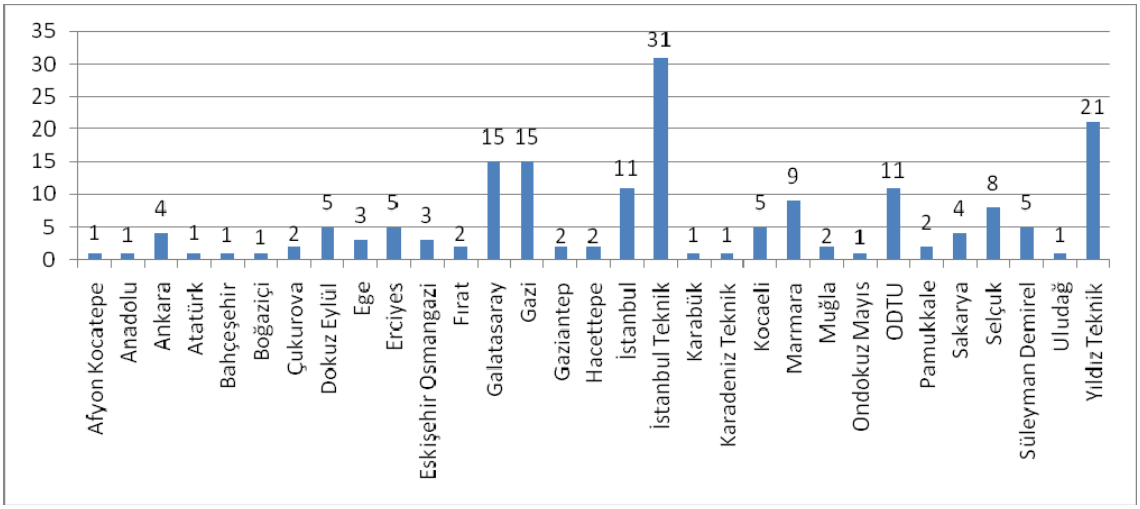

Figure 7. Number of studies in each university

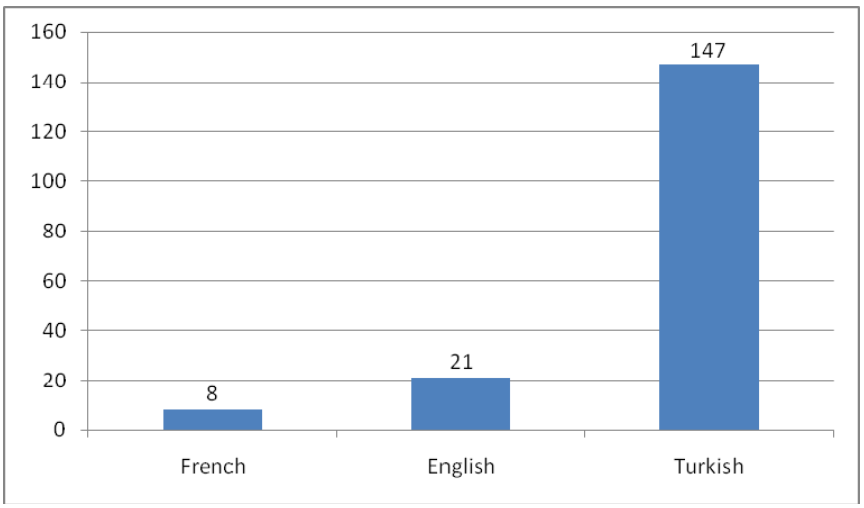

Figure 8. Languages of theses

6. Future Recommendations

As a topic, there are few studies on some topics (medicine and education). It is recommended for researchers to study on these topics. As a decision making method, there is only one study which used ELECTRE III or TOPSIS. There could be more study using these methods. Also, there is no study using VIKOR or PROMETHEE. Furthermore, MODM techniques are rarely used. However, there are various applications in literature. They can be used and compared with previous ones, especially evolutionary algorithms. Moreover, it is seen that fuzzy decision making methods have generally been applied to select a candidate or predict the system response but evaluation of a system or performance is also another application area that should be studied.

7. Conclusions and Discussions

This study is aimed to reveal studies on fuzzy decision making in Turkish Universities. Fuzzy decision making studies are given in an organized way. Refereed theses are searched on the website of Turkish Council of Higher Education. This work is a small part of another work

that all fuzzy logic studies at all Turkish universities are searched and then classified. All data belong to the database formed up to the 2010. Even though some studies may be not yet registered to the database; it is believed that their number is few. Obtained results are given as tables and graphs.

It is noted that fuzzy decision making follows fuzzy logic control in interest to study and trend in using fuzzy decision making is getting higher eventhough it has begun to study lately. Number of published articles also proved this fact. The results suggest that more researchers should specialize in this area because most of the studies are done by a few researchers and in a few universities.

References

Adalı, M.R., Savunma sanayiinde teknolojik zeka, yenilik, tasarım ve rekabet stratejilerinin bulanık mantık ile değerlendirilmesi. MSc Thesis (in Turkish), Sakarya University, 2003

Afacan, İ.E., Harp gemisi elektrik dağıtım sisteminde arıza yerinin belirlenmesinde bulanık karar verme yönteminin uygulanması. MSc Thesis (in Turkish), İstanbul Technical University, 2005

Afşar, S., Yapay sinir ağları ve bulanık mantık yöntemleri kullanılarak tava buharlaşma tahmini yapılması. MSc Thesis (in Turkish), Erciyes University, 2008

Ahlatçıoğlu, B., Bulanık karar verme ve tesis yeri seçimine bir uygulama. MSc Thesis (in Turkish), İstanbul University, 2005

Ahlatçıoğlu, B., Portföy seçimine bulanık yaklaşımlar. MSc Thesis (in Turkish), Marmara University, 2005

Akbay, S., Askeri birliklerde personel yeterliliği için bulanık uzman sistem tasarımı. MSc Thesis (in Turkish), Turkish Military Academy, 2004

Akbıyık, T., Hidrojen yakıtı kullanılan bir dizel motorun emisyonlarının bulanık uzman sistem ile modellenmesi. MSc Thesis (in Turkish), Selçuk University, 2008

Akçay, C., Avrupa uygunluk kriterlerine göre bir kamu ihale karar destek modeli. PhD Thesis (in Turkish), İstanbul University, 2008

Akgül, M., Bulanık mantık algoritmasının talep tahmininde kullanılması. MSc Thesis (in Turkish), İstanbul University, 2001

Akpınar, E., Software selection for a liner shipping company using fuzzy logic decision making. MSc Thesis (in Turkish), Boğaziçi University, 2005

Aksakal, E., Bulanık aksiyomatik tasarım yönteminin personel seçim problemine uygulanması. MSc Thesis (in Turkish), Gazi University, 2009

Aksoy, S., İnşaat mühendisliğinde çok amaçlı değerlendirme ve karar vermede fuzzy yaklaşımı. MSc Thesis (in Turkish), İstanbul University, 2003

Akyüz, M.H., Une approche floue d'analyse d'enveloppement des données au probléme de sélection de fournisseur. MSc Thesis (in French), Galatasaray University, 2005

Alioğlu, E., Belediyelerde performans ölçümü için çok ölçütlü bulanık bir model önerisi. MSc Thesis (in Turkish), İstanbul Technical University, 2006

Aliustaoğlu, C., Rulman arızalarının gerçek zamanda analizi ve arıza kaynaklarının tespit edilmesi. MSc Thesis (in Turkish), Kocaeli University, 2008

Alkan, A., AHP`de dilsel karşılaştırma sürecinin bulanık mantıkla gerçekleştirilmesi. MSc Thesis (in Turkish), Kocaeli University, 2006

Alkan, B., Jeoistatistik ve bulanık yaklaşımlar ile Adana çimento hammadde sahasının değerlendirilmesi. MSc Thesis (in Turkish), Çukurova University, 2007

Altunal, S., Bulanık veri zarflama analizi üzerine bir araştırma, MSc Thesis (in Turkish), Dokuz Eylül University, 2006

Altuntaş, C., Yapay zeka algoritmaları ve tesis planlamasında bulanık küme bazlı uzman sistem yaklaşımı. MSc Thesis (in Turkish), Gazi University, 2004

Arı, E., Bulanık mantık tabanlı mesleki yönlendirme. MSc Thesis (in Turkish), Sakarya University, 2009

Armağan, H., Öğrenci akademik performans değerlendirmesi için yeni bir yaklaşım. MSc Thesis (in Turkish), Süleyman Demirel University, 2008

Artuç, A., Askeri telsiz sistemlerinin performansının bulanık karar ortamında değerlendirilmesi. MSc Thesis (in Turkish), İstanbul Technical University, 2001

Aslan, E., Bulanık analitik hiyerarşi prosesi yöntemi yardımıyla tedarikçi seçimi ve üretim sektöründe bir uygulama. MSc Thesis (in Turkish), Dokuz Eylül University, 2009

Atalan, B., Bulanık mantık ve sermaye bütçelemesinde uygulanması. MSc Thesis (in Turkish), Ankara University, 2003

Aydemir, O., Kentsel yaşam kalitesi değerlendirmesinde bulanık küme modeli: Örnek Alan Zeytinburnu ilçesi. PhD Thesis (in Turkish), Yıldız Technical University, 2008

Aydın, T., Bulanık mantık sınıflandırmadan yararlanarak kablo malzemesi seçimi. MSc Thesis (in Turkish), İstanbul Technical University, 2004

Bakanay, D., Mikro öğretimde performansın bulanık mantık yöntemiyle değerlendirilmesi. MSc Thesis (in Turkish), Marmara University, 2009

Bali, Ö., AHP, bulanık AHP ve bulanık mantıkla Kara Harp Okuluna öğretim elemanı seçimi. MSc Thesis (in Turkish), Gazi University, 2004

Ballı, S., Fuzzy çok kriterli karar verme ve basketbolda oyuncu seçimine uygulaması. MSc Thesis (in Turkish), Muğla University, 2005

Baltacıoğlu, G., Stok parti büyüklerinin belirlenmesi için dinamik yaklaşımlar ve bulanık Wagner Whitin algoritması (1 nci sınıf ikmal maddeleri uygulaması). MSc Thesis (in Turkish), Turkish Military Academy, 2004

Barışçı, N., Kardiyak doppler sinyallerine hızlı fourier dönüşümü analizi uygulayarak elde edilen sonuçların bulanık mantık ile değerlendirilmesi. MSc Thesis (in Turkish), Gazi University, 2000

Baş, E., Bulanık analiz ve modelleme ile ekonomi sistemi içinde borsa bileşik endeksi çıkaran uzman sistem tasarımı. MSc Thesis (in Turkish), Yıldız Technical University, 1995

Başkömürcü, A., Bulanık mantıkla hazırlanmış kural tabanının bir öngörü sisteminde kullanılması. MSc Thesis (in Turkish), Ege University, 1995

Bayrak, M.Y., Bulanık mantık yaklaşımıyla tedarikçi seçim metodu. MSc Thesis (in Turkish), Eskişehir Osmangazi University, 2004

Baysal, M.E., Bulanık karar ortamında performans değerlendirme: Türk yüksek öğretim sisteminde yapılan bir etkinlik analizi. PhD Thesis (in Turkish), Gazi University, 2005

Bellman, R., Zadeh, L.A., Decision making in a fuzzy environment. Management Science, 17B(4), 149-156, 1970

Beyan, T., A new fuzzy-cohaotic modelling proposal for medical diagnostic processes. MSc Thesis (in English), Middle East Technical University, 2005

Bilen, E., A Neurofuzzy network models for wle-bsed systems. MSc Thesis (in English), Middle East Technical University, 1997

Bilgin, Ö., Hata türü ve etkileri analizinde bulanık mantık uygulaması. MSc Thesis (in Turkish), Kocaeli University, 2006

Bilsel, R.U., Une approche multi-critére flou á la gestion de portefeuille. MSc Thesis (in French), Galatasaray University, 2005

Boran, F.E., Personel seçimi probleminde sezgisel bulanık küme uygulaması. MSc Thesis (in Turkish), Gazi University, 2009

Boyacı, H., Computer imlementation of fuzzy decision making with an application to nuclear power plan site election. MSc Thesis (in English), İstanbul Technical University, 1994

Boz, Y., GPS ölçülerindeki uyuşumsuz ölçülerin geleneksel, robust ve bulanık mantık yöntemleriyle belirlenmesi. MSc Thesis (in Turkish), Karadeniz Technical University, 2005

Budayan, C., Strategic group analysis: Strategic perspective, differentiation and performance in construction. PhD Thesis (in English), Middle East Technical University, 2008

Canaslan, İ., Fuzzy karar yaklaşımının poliçe prim hesabına uygulanması. MSc Thesis (in Turkish), Marmara University, 1996

Canbol, M.E., Kalite esaslı yatırımların seçiminde bulanık dilsel metodun ve analitik hiyerarşi metodunun karşılaştırılması. MSc Thesis (in Turkish), Gazi University, 2002

Cengiz, M., Türkiye'deki mevcut koşulların bulanık analitik ağ süreciyle değerlendirilerek uygun tersane yeri seçimi. MSc Thesis (in Turkish), Yıldız Technical University, 2007

Chen, S.-J., Hwang, C.-L., Fuzzy multiple attribute decision making: Methods and applications. Springer, New York, 1992

Çakır, A., Silah etkinlik katsayılarının bulanık mantık yöntemi ile tespit edilmesi. MSc Thesis (in Turkish), Turkish Military Academy, 2004

Çakır, E., Logistics outsourcing and selection of third party logistics service provider (3PL) via fuzzy AHP. MSc Thesis (in English), Bahçeşehir University, 2009

Çakır, S., Türk Kara Kuvvetleri ana muharebe tankı seçiminde analitik hiyerarşi metodu ve bulanık kümeler. MSc Thesis (in Turkish), İstanbul Technical University, 2001

Çakıt, E., El becerisine etki eden faktörlerin değerlendirilmesine yönelik bulanık mantık yaklaşımı. MSc Thesis (in Turkish), Çukurova University, 2008

Çatinsaya, V., Çok kriterli kaynak tahsisi problemlerinin optimizasyonunda bulanık karar verme yöntemlerinin uygulanması. MSc Thesis (in Turkish), Yıldız Technical University, 2004

Çavuş, U.Ş., Deprem sebebiyle zeminlerin sıvılaşma potansiyelinin bulanık mantık modellemesi (fuzzy logic modelling) ile değerlendirilmesi. PhD Thesis (in Turkish), Süleyman Demirel University, 2004

Çelik, Y., Pnomatik ekim makinelerinde tohum dağılım düzgünlüğünün elektronik sistemlerle saptanması ve bulanık mantık ile değerlendirilmesi. MSc Thesis (in Turkish), Selçuk University, 2004

Çitli, N., Bulanık çok kriterli karar verme. MSc Thesis (in Turkish), Yıldız Technical University, 2006

Çolak, Ş., Kural tabanlı bulanık sistemlerde yeni çıkarım algoritmalarının incelenmesi ve simülasyonu. MSc Thesis (in Turkish), Uludağ University, 1997

Çolpan, C., 2nci Hava İkmal Bakım Merkezi Komutanlığı üretim atölyelerinde performans ölçüm ve değerlendirmesi. MSc Thesis (in Turkish), Erciyes University, 2008

Demircan, M.L., Bulanık yenileme analizi. PhD Thesis (in Turkish), İstanbul Technical University, 2004

Demirdağ, E.A., Evaluation de la performance humaine et selection des candidats avec le controle par la logique floue. MSc Thesis (in French), Galatasaray University, 2000

Deniz, E., Bulanık mantık tabanlı tahmin modeli ve uygulaması. MSc Thesis (in Turkish), Muğla University, 2006

Dilsiz, S., Bulanık mantık ve yapay sinir ağları ile Türkçe yazım denetleyicisi. MSc Thesis (in Turkish), İstanbul Technical University, 2005

Doğan, O., Esnek üstyapılı devlet yollarındaki bozulmaların bulanık mantık ile tahmini. MSc Thesis (in Turkish), İstanbul Technical University, 2006

Dubois, D., Prade, H., Recent models of uncertainty and imprecision as a basis for decision theory: Toward less normative frameworks. In: Intelligent Decision Support in Process Environments, Eds. E. Hollnagel, G. Mancini and D. Woods, 3-24, 1985

Durdudiler, M., Perakende sektöründe tedarikçi performans değerlemesinde AHP ve bulanık AHP uygulaması. MSc Thesis (in Turkish), Yıldız Technical University, 2006

Dursun, M., Evaluating solid waste management scenarios using fuzzy multi-criteria decision making approaches. MSc Thesis (in English), Galatasaray University, 2007

Ecer, F., Fuzzy Topsis yöntemiyle insan kaynağı seçiminde adayların değerlemesi ve bir uygulama. PhD Thesis (in Turkish), Afyon Kocatepe University, 2007

Efendigil, T., Müşteri odaklı sistemler için yapay sinir ağı ve bulanık çıkarım tabanlı bir karar destek sistemi yaklaşımı. PhD Thesis (in Turkish), Yıldız Technical University, 2008

Efstathiou, J., A practical development of multi-attribute decision making using fuzzy set theory. Ph.D. Thesis, Department of Comput., University of Durham, England, 1979

Ekici, D., Determining optimum pricing strategy for a telecommunications service by using fuzzy extended AHP. MSc Thesis (in English), Galatasaray University, 2007

Engelkıran, M., Fuzzy çoklu kritere göre karar vermenin insan kaynaklarına uygulanması. MSc Thesis (in Turkish), Marmara University, 2001

Ercan, İ., A fuzzy based decision support system for locational suitability of settlements, Odunpazarı, Eskişehir case study. MSc Thesis (in English), Middle East Technical University, 2006

Erdinç, O., Dalgacık dönüşümü/bulanık mantık tabanlı enerji yönetim stratejisi kullanılarak yakıt hücresi/ultra-kapasitörlü hibrit taşıt sisteminin modellenmesi ve analizi. MSc Thesis (in Turkish), Yıldız Technical University, 2008

Erkut, A.S., L'application de la methode AHP flou etendue aux problemes de selection de la strategie de gestion des relations clientele. MSc Thesis (in French), Galatasaray University, 2008

Ertuğ, F., Modele de determination de prix de vente effectif flou. MSc Thesis (in French), Galatasaray University, 2000

Erümit, A.K., Bulanık AHS yöntemi ile fen bilimleri enstitüleri için master öğrencisi seçimi. MSc Thesis (in Turkish), Gazi University, 2007

Evans, G.W., An overview of techniques for solving multiobjective mathematical programme. Management Science, 30(11), 1984

Fazlıoğulları, O., Bulanık (fuzzy) matematikle ömür devri maliyeti risk analizi (Bir uygulama: Bilgisayar dersanesi projesi). MSc Thesis (in Turkish), Turkish Military Academy, 2003

Genç, S., Sezgisel bulanık tercih ilişkisi ve tedarikçi seçimine uygulanması. MSc Thesis (in Turkish), Gazi University, 2009

Gökdalay, M.H., Hava alanlarının performans analizinde bulanık çok ölçütlü karar verme yaklaşımı. PhD Thesis (in Turkish), İstanbul Technical University, 2008

Göksu, A., Bulanık analitik hiyerarşik proses ve üniversite tercih sıralamasında uygulanması. PhD Thesis (in Turkish), Süleyman Demirel University, 2008

Göktürk, İ.F., Tedarikçi performans değerlendirmesinde bulanık AHP uygulaması. MSc Thesis (in Turkish), Kocaeli University, 2008

Görkemli, L., Üretim süreçlerinin güvenilirliğinin bulanık Bayesgil yöntemi ile belirlenmesi. MSc Thesis (in Turkish), Erciyes University, 2009

Gözen, M., İşletmelerde şirket değerlemesinde yeni bir yaklaşım, Fuzzy Küme Teorisi. PhD Thesis (in Turkish), Ankara University, 2001

Güleç, A., İmalat sanayiinin performansını değerlendirmede bulanık küme ve yaklaşık çıkarsama yaklaşımı. MSc Thesis (in Turkish), İstanbul Technical University, 1996

Gültaş, İ., Endüstri mühendisliği eğitiminde matematik ders içeriklerinin belirlenmesine bulanık AHP yöntemi ile çözüm önerisi. MSc Thesis (in Turkish), İstanbul Technical University, 2007

Günay, H., Bulanık karar vermede birleştirme operatörleri ve uygulamaları. MSc Thesis (in Turkish), Yıldız Technical University, 2006

Güner, H., Bulanık AHP ve bir işletme için tedarikçi seçimi problemine uygulanması. MSc Thesis (in Turkish), Pamukkale University, 2005

Güneş, T., Bulanık veri zarflama analizi. MSc Thesis (in Turkish), Ankara University, 2006

Gürbüz, F., Seramik üretiminde hamur kalitesinin bulanık sistem yöntemiyle belirlenmesi. MSc Thesis (in Turkish), Erciyes University, 2003

Gürkanlı, G.E., İnşaat şantiyelerinde bulanık kümeler yardımıyla iş güvenliği risk analizi yöntemi. PhD Thesis (in Turkish), İstanbul Technical University, 2006

Gürün, H., Derin çekme kalıplarındaki parametrelerin deneysel olarak incelenmesi ve bulanık mantık ile tahmini. PhD Thesis (in Turkish), Gazi University, 2008

Han, S., Estimation of cost overrun risk in international projects by using fuzzy set theory. MSc Thesis (in English), Middle East Technical University, 2005

Hwang, C.L., Yoon, K., Multiple attribute decision making - Methods and Applications, A state of the art survey. Springer-Verlag, Newyork, 1981

Işıklar, G., L'evaluation des alternatives de paiement electronique avec des methodes floues d'aide a la decisions. MSc Thesis (in French), Galatasaray University, 2003

İlkaz, S., CNC tornalama işlemlerinde kesme parametrelerinin bulanık mantık ile belirlenmesi. MSc Thesis (in Turkish), Süleyman Demirel University, 2002

İnan, U.H., Kalite yönetim sistemlerinde tetkik performansının bulanık mantık ile analitik hiyerarşi süreci ve bulanık analitik ağ süreci kullanılarak ölçülmesi. PhD Thesis (in Turkish), Yıldız Technical University, 2008

İpek, Ö., Göreve yönelik bulanık tabanlı uzman araç alım karar sistemlerinin oluşturulması J. GN. K. lığında örnek bir uygulama. MSc Thesis (in Turkish), Turkish Military Academy, 2004

İphar, M., Bulanık kümelerin sökücü seçimi amacıyla kazılabilirlik sınıflama sistemlerine uygulanması. PhD Thesis (in Turkish), Eskişehir Osmangazi University, 2004

İşcan, F., Arazi düzenleme çalışmalarında bulanık mantık uygulaması. PhD Thesis (in Turkish), Selçuk University, 2009

Kabak, Ö., Türkiye'nin sürdürülebilir kalkınmadaki yeri: Bir bulanık çok ölçütlü karar verme yaklaşımı. MSc Thesis (in Turkish), İstanbul Technical University, 2003

Kahraman, C., İleri imalat teknolojilerinin ekonomik analizi ve esneklik faktörünün sayısallaştırılmasına bulanık kümeler yaklaşımı. PhD Thesis (in Turkish), İstanbul Technical University, 1996

Kahraman, H., Türk silahlı kuvvetlerinde piyade tüfeği seçimi için bulanık karar ortamında analitik hiyerarşi metodunun uygulanması. MSc Thesis (in Turkish), İstanbul Technical University, 2000

Kahya, E., İnsangücü seçiminde bulanık uzman sistemler yardımıyla iş başvuru formlarının değerlendirilmesi. MSc Thesis (in Turkish), Erciyes University, 2003

Kankılıç, H., Development of a fuzzy decision making model for personnel selection. MSc Thesis (in English), Gaziantep University, 2005

Kaplan, S., Hava savunma sektörü tezgah yatırım projelerinin bulanık AHP ile değerlendirilmesi. MSc Thesis (in Turkish), Gazi University, 2007

Kaptanoğlu, D., Akademik performans değerlendirmesi için bir çok ölçütlü bulanık karar verme modeli. PhD Thesis (in Turkish), İstanbul Technical University, 2005

Karaarslan, N., İmalat sektöründe tedarikçi yeterlilik analizi için bir bulanık karar destek sistemi. PhD Thesis (in Turkish), Sakarya University, 2008

Karabay, M., Uluslararası inşaat sektöründe politik risk ve bulanık kümeler yardımıyla analizi için bir yöntem önerisi. PhD Thesis (in Turkish), İstanbul Technical University, 1997

Karahan, Ç., Bulanık küme teorisi ile yüksek seviyede buzlanma potansiyelini tahmin eden program tasarımı. MSc Thesis (in Turkish), Gazi University, 2007

Karakaşoğlu, N., Bulanık çok kriterli karar verme yöntemleri ve uygulama. MSc Thesis (in Turkish), Pamukkale University, 2008

Karaköse, M., Elektrik motorlarında fiziksel büyüklüklerin tahmininde bulanık mantık kullanımı. MSc Thesis (in Turkish), Fırat University, 2001

Karanfil, S., Fuzzy lojik problemlerinde üyelik fonksiyonunun belirlenmesinde deneysel verilere dayanarak bir yöntem geliştirilmesi. PhD Thesis (in Turkish), Yıldız Technical University, 1997

Kavraal, S.Ç., Bulanık mantık yöntemi ile içten yanmalı motorlardaki marş motoru arızalarının belirlenmesi. MSc Thesis (in Turkish), Selçuk University, 2009

Kaya, P., Ekonomik aktörlerin enflasyonla ilgili beklentilerinin fuzzy değişkenleriyle belirlenmesi ve ölçülmesi. MSc Thesis (in Turkish), Marmara University, 2006

Kentli, A., Studies on fuzzy logic control of electrical machines in Turkish Universities: An Overview, Mathematical and Computational Applications, Vol. 16, No. 1, pp. 236-247, 2011

Kınay, A.Ö., On the construction of student groups in a problem based learning system through fuzzy logic considering various objectives. PhD Thesis (in English), Dokuz Eylül University, 2008

Kıyak, B., Stokastik yaşam süresi için bulanık hayat sigortası. MSc Thesis (in Turkish), Hacettepe University, 2005

Kodalak, A., Akaryakıt istasyonu seçme problemine coğrafi bilgi sistemleri ve bulanık analitik ağ prosesi yaklaşımı. MSc Thesis (in Turkish), Yıldız Technical University, 2009

Kop, Y., Fuzzy multi-criteria decision making in solid waste collection system in Turkey. MSc Thesis (in English), Galatasaray University, 2007

Kuşan, H., İnşaat projelerinde risklerin bulanık mantık modeli ile değerlendirilmesi. PhD Thesis (in Turkish), Eskişehir Osmangazi University, 2009

Kuşçu, D., Karar verme süreçlerinde bulanık mantık yaklaşımı. MSc Thesis (in Turkish), Marmara University, 2007

Kuzgunkaya, O., La selection d'un systeme de production flexible (SPF) par la programmation lineaire booleenne floue. MSc Thesis (in French), Galatasaray University, 2000

Küçük, A.E., Belirsizlik altında yatırım kararlarının verilmesi - Türkiye örneği: Bulanık küme yaklaşımı. MSc Thesis (in Turkish), İstanbul Technical University, 2004

Küçüköncü, T., A Critical survey of fuzzy logic as a basis for approximate reasoning. MSc Thesis (in English), Middle East Technical University, 1996

Küçümen, B.Ö., A Decision support system for fuzzy scheduling of software project. MSc Thesis (in English), Middle East Technical University, 1999

Menteş, A., Manevra ve sevk sistemi seçiminde bulanık çok kriterli karar verme. MSc Thesis (in Turkish), İstanbul Technical University, 2000

Mert, A., Bulanık bilgilerin bir araya getirilme problemleri ve onların karar verme modellerinde kullanılması. MSc Thesis (in Turkish), Ege University, 2003

Mete, M., Bakım yönetiminde bulanık çok amaçlı karar verme modeli. PhD Thesis (in Turkish), İstanbul University, 2007

Mızrak, C., Bulanık mantık yardımıyla müşteri istemli ürün geliştirme. MSc Thesis (in Turkish), Karabük University, 2009

Mikail, R., Tuzlu toprakların ıslahı için bir bulanık uzman sistem tasarımı. MSc Thesis (in Turkish), Selçuk University, 2007

Muşdal, H., Tıbbi atıkları işleme ve bertaraf etme teknolojisi seçme problemine bulanık analitik hiyerarşi prosesi ve bulanık analitik ağ prosesi yaklaşımı. MSc Thesis (in Turkish), Yıldız Technical University, 2007

Okul, D., Analitik ağ süreci ve bulanık mantık kullanımıyla kalite fonksiyon yayılımının mobilya sektöründe uygulanması. MSc Thesis (in Turkish), Gazi University, 2007

Oranlı, G., Radyo frekansıyla tanımlama teknolojisinin uygulanması kararının bulanık a nalitik hiyerarşi yöntemi ile değerlendirilmesi: Bankacılık sektöründe bir uygulama. MSc Thesis (in Turkish), İstanbul Technical University, 2007

Oruç, K.O., Veri zarflama analizi ile bulanık ortamda etkinlik ölçümleri ve üniversitelerde bir uygulama. PhD Thesis (in Turkish), Süleyman Demirel University, 2008

Ölçer, A.İ., Development a new fuzzy multiple attribute decision making approach and its application to decision making in ship design and shipbuilding. PhD Thesis (in English), İstanbul Technical University, 2001

Önal, S.A., Fuzzy analytic hierarchy based approach for supplier selection in a washing machine company. MSc Thesis (in English), Dokuz Eylül University, 2006

Öz, A.H., Yük helikopter seçiminde bulanık çok kriterli karar verme modeli. PhD Thesis (in Turkish), İstanbul University, 2007

Özdağoğlu, A., "Bulanık analitik serim süreci" yaklaşımı ile çok ölçütlü karar verme ve bir işletme uygulaması. PhD Thesis (in Turkish), Dokuz Eylül University, 2008

Özdemir, O., Bulanık mantık ile belirlenmiş öğrenme stillerine dayalı öğrenme ortamlarının öğrencilerin başarı ve tutumlarına etkisi. PhD Thesis (in Turkish), Fırat University, 2009

Özdemir, Y., Turizm yatırımlarının bulanık çok amaçlı değerlendirilmesi. MSc Thesis (in Turkish), Yıldız Technical University 2009

Özel, B., Bulanık aksiyomatik tasarım yaklaşımı ile hiyerarşik bir tedarikçi seçim modeli. MSc Thesis (in Turkish), Gazi University, 2007

Özkan, E.M., Fuzzy mantıkta yaklaşık usavurma ve bir probleme uygulanması. PhD Thesis (in Turkish), Yıldız Technical University, 1998

Özkan, İ.A., Tornalamada kesme kuvvetlerinin ve takım ucu sıcaklığının bulanık mantık ve yapay sinir ağı teknikleriyle tahmin edilmesi. MSc Thesis (in Turkish), Selçuk University, 2006

Özkök, Y.İ., WEB based ionospheric forecasting using neural network and neurofuzzy models. MSc Thesis (in English), Middle East Technical University, 2005

Öztürk, R.Ö., Fuzzy karar verme. MSc Thesis (in Turkish), Marmara University, 1999

Öztürk, T., Hata türü ve etkileri analizinde bulanık mantık kullanarak bir kamu hastanesinin satın alma sürecinin iyileştirilmesi. MSc Thesis (in Turkish), Kocaeli University, 2008

Reznik, L., Fuzzy controllers. Newnes, Oxford, 1997

Riaz, M., Sızma ölçümleri ve en uygun kanal kaplama malzemesi için hassas yöntem seçimi (bulanık mantık tekniğinden yararlanarak). PhD Thesis (in Turkish), İstanbul Technical University, 2005

Sağlam, U., Tedarik zinciri yönetiminde satış dağıtım fonksiyonunun performansının tedarik zinciri performansı üzerindeki etkisinin incelenmesi. PhD Thesis (in Turkish), Yıldız Technical University, 2008

Sarıbık, H., Bir bulanık uzman sistem kabuk prototipi. MSc Thesis (in Turkish), İstanbul Technical University, 1995

Satı, M.M., Ulaştırma yatırımlarının değerlendirilmesinde bulanık mantık yaklaşımıyla katılımcı bir karar destek sistemi. PhD Thesis (in Turkish), İstanbul Technical University, 2000

Semercioğlu, M., Bulanık risk analizi ile proje risk yönetimi modeli ve bir ana malzeme projesinde uygulanması. MSc Thesis (in Turkish), Turkish Military Academy, 2005

Sen, P., Yang, J. B., Multiple Criteria Decision Support in Engineering Design. Springer, New York, 1998

Serhadlıoğlu, G., Bulanık-AHP ve ELECTRE III yöntemlerinin personel seçimi problemine uygulanması. MSc Thesis (in Turkish), Gazi University, 2004

Sıkıcı, A., Bulanık mantık tabanlı uzman sistem kabuğu. MSc Thesis (in Turkish), Ege University, 2000

Şentürk, S., Deney planlamasında bulanık mantık yaklaşımı. PhD Thesis (in Turkish), Anadolu University, 2006

Tabucanon, M.T., Multiple criteria decision making in industry. Elsevier, 1988

Tan, E., Short term system load forecasting using fuzzy neural networks. MSc Thesis (in English), Middle East Technical University, 1997

Taş, F., İnşaat firmalarının kredilendirilmesinde fuzzy yaklaşımı. MSc Thesis (in Turkish), İstanbul University, 2005

Taşdemir, Ş., Benzinli bir motorun performans ve emisyon karakteristiklerinin belirlenmsi için bulanık uzman sistem tasarımı. MSc Thesis (in Turkish), Selçuk University, 2004

Tekeş, M., Çok ölçütlü karar verme yöntemleri ve Türk Silahlı Kuvvetlerinde kullanılan tabancaların bulanık uygunluk indeksli analitik hiyerarşi prosesi ile karşılaştırılması. MSc Thesis (in Turkish), İstanbul Technical University, 2002

Tekin, B., Bulanık bileşenli çözümleme yöntemi kullanarak proje ekiplerinin seçilmesi. MSc Thesis (in Turkish), İstanbul Technical University, 2004

Tiryaki, C., Fuzzy bayes karar verme ve bir üretim problemine uygulanması. MSc Thesis (in Turkish), Marmara University, 1998

Topel, A., Analitik hiyerarşi prosesinin bulanık mantık ortamındaki uygulamaları - bulanık analitik hiyerarşi prosesi. MSc Thesis (in Turkish), İstanbul University, 2006

Tortum, A., Yapay sinir ağları ve birleştirilmiş sinirsel bulanık sistemler ile şehirlerarası yük taşıması tür seçiminin modellenmesi. PhD Thesis (in Turkish), Atatürk University, 2003

Torun, S., Koroner kalp hastalığı riski tanısı ve tedavisi için hiyerarşik bir bulanık uzman sistem tasarımı. MSc Thesis (in Turkish), Selçuk University, 2007

Tosunoğlu, N.G., Mekansal istatistikte bulanık uyarlamalı ağ yaklaşımı ile depremi oluşturan yer kabuğu hareket hızlarının kestirimi. PhD Thesis (in Turkish), Ankara University, 2007

Turgay, S., Sürekli imalatta bulanık kural tabanlı uzman sistem tasarımı. MSc Thesis (in Turkish), Sakarya University, 1997

Türker, N.K., Belirtisiz istatistikten yararlanılarak matematik eğitimi derslerine yönelik tutumun belirlenmesi. MSc Thesis (in Turkish), Hacettepe University, 2007

Türkoğulları, Y.B., Une nouvelle procédure de décision multi-objectif floue pour la sélection de systéme d'informatique. MSc Thesis (in French), Galatasaray University, 2004

Tüysüz, F., Proje risk analizinde bulanık analitik hiyerarşi prosesinin kullanılması. MSc Thesis (in Turkish), İstanbul Technical University, 2004

Ulubeyli, S., Uluslararası inşaat projelerinde alt yüklenici seçimi için bulanık çok ölçütlü karar verme modeli. PhD Thesis (in Turkish), İstanbul University, 2008

Uzun, K.P., Mesleki ve Technical eğitim okullarında öğrencileri alana yöneltmede uzman sistem yaklaşımı. MSc Thesis (in Turkish), Marmara University, 2008

Ünlüyıldız, E., Risk evaluation of an ERP implementation project using Fuzzy Extended AHP (FEAHP). MSc Thesis (in English), Galatasaray University, 2007

Üzgün, T., Bulanık analitik hiyerarşi prosesi. MSc Thesis (in Turkish), Yıldız Technical University, 2006

Yakut, E.Ö., Bulanık mantık ile Türk Deniz Kuvvetlerinin gereksinimine uygun gemi seçimi. MSc Thesis (in Turkish), Yıldız Technical University, 2004

Yalçın, U., Bulanık analitik hiyerarşi prosesi kullanarak rüzgar enerjisi santral yeri seçimi. MSc Thesis (in Turkish), Yıldız Technical University, 2007

Yanar, T.A., The enhancement of the cell-based GIS analyses with fuzzy processing capabilities. MSc Thesis (in English), Middle East Technical University, 2003

Yel, İ., Lojistik sektöründe bulanık mantık karar sürecinin uygulanması. MSc Thesis (in Turkish), Yıldız Technical University, 2009

Yıldız, G., CIM yatırımlarının bulanık AHP yöntemi ile değerlendirilmesi. MSc Thesis (in Turkish), İstanbul Technical University, 2003

Yılmaz, O., Computer aided selection of cutting parameters by using fuzzy logic. MSc Thesis (in English), Gaziantep University, 1999

Yılmaz, S., Uçak seçim kriterlerinin değerlendirilmesinde AHP ve bulanık AHP uygulaması. MSc Thesis (in Turkish), Yıldız Technical University, 2006

Yolcu, U., Yapay sinir ağına dayalı yüksek dereceli bulanık zaman serisi öngörü modeli. MSc Thesis (in Turkish), Ondokuz Mayıs University, 2008

Yonar, Y.B., Genel amaçlı bir bulanık uzman system. MSc Thesis (in Turkish), İstanbul Technical University, 1999

Yürekli, H., Bulanık uzman sistemler. MSc Thesis (in Turkish), İstanbul University, 1999

Zadeh, L.A., Fuzzy Sets. Information and Control, 8, 338–353, 1965