MODELLING AND ANALYZING SUCCESS FACTORS OF THE TELEVISION DRAMAS BY USING FUZZY COGNITIVE MAP TECHNIQUE

(TELEVİZYON DİZİLERİNİN BAŞARI FAKTÖRLERİNİN BULANIK BİLİŞSEL HARİTALAMA TEKNİĞİ KULLANILARAK MODELLENMESİ VE ANALİZ EDİLMESİ)

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MELEK RODOPLU
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LIST OF SYMBOLS

ANN : Artificial Neural Network

AL : Activation Level

AMS : Aggregated Matrix of Supporting Factors

ATS : Avarage Time Spent

CM : Cognitive Map

CoG : Centre of Gravity

CPM : Cost Per Thousand

ERM : Evolutionary Rating Model

FCM : Fuzzy Cognitive Map

FMEA : Failure Mode Effects Analysis

GDP : Gross Domestic Product

GIS : Geographic Information System

GRP : Gross Rating Points

HR : Human Resources

IGA : Intelligent Genetic Algorithm

IMS : Initial Matrix of Supporting Factors

KPI : Key Performance Indicator

NM : Negatively Medium

NS : Negatively Strong

NVS : Negatively Very Strong

NW : Negatively Weak

PM : Positively Medium

PS : Positively Strong

PVS : Positively Very Strong

PW : Positively Weak

RFID : Radio Frequency Identification

TV : Television

U&G : Uses and Gratification

WMS : Weigted Matrix of Supporting Factors

Z : Zero

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ABSTRACT

In recent years, despite the rapid increase in technological developments, television still keeps its place in our daily life. Television is sometimes seen as a means of getting information, sometimes a friend for leisure time or sometimes seen as a means to get rid of the fatigue and stress of the day by human being, thus it can still maintain its popularity despite all the other options.

In this study, especially in recent years, Turkish television dramas that have become a television phenomenon and the factors affecting the success of the dramas have been examined and analyzed in detail. Latest research conducted by Deloitte (2014) points out that each year, average 50-70 television dramas are released but more than half of them is removed after a couple of episodes are shown on the television due to the severe competition. As a nature result of this competitive environment, obtained low rating levels cause the abolition of television dramas.

When the economic aspect of the subject is considered, to be able to achieve high rating levels, working with the celebrities is a key success factor. According to research done by Deloitte (2014), the amount paying for the actor/actress constitutes the largest cost item in the budget. When the star value of them increases, the ratio reaches to 45% of the total cost is allocated for the players' budget. Additionally, a considerable amount of money is invested for the directors and scriptwriters. These costs are followed by the operational and logistic costs. Production companies sell their products to the television channels by adding %20-%40 of the total cost (Sözeri & Güney, 2011). Advertisers or brands invest in these productions offering the opportunity to reach many potential customers and also television channels obtain revenue by this way. Each failed television drama causes cracking in this economic ring.

Television channels that purchased the drama failed to obtain the desired rating level, both venture purchasing costs for a unsuccessful product and fail to achieve targeted revenue and this situation reflects as a great loss to the balance sheet. When the financial aspect of the subject is examined, to predict whether a television drama achieve high rating level before it is released has a vital importance for all the shareholders of the industry.

In this study, the success factors of a television drama have been identified, analyzed and modelled by using Fuzzy Cognitive Map technique.
Obtained model allows to monitor the impact of various changes in the value of success factors on viewing ratio by performing scenario analysis and facilitates prediction and decision-making process accordingly.
Keywords: Television Dramas, Fuzzy Cognitive Map, Success Factors,Ratings

LE RESUME

De nos jours, malgré le développement prompt de la technologie, la télévision conserve encore sa place dans notre vie quotidienne. La télévision est parfois considérée comme un moyen pour obtenir des informations, parfois comme un ami pour la distraction ou parfois comme un moyen pour se débarrasser de la fatigue et du stress de la journée, d'ou il peut encore maintenir sa popularité en dépit de toutes les autres options.

Dans cette dissertation, les drames turcs devenus phénoménales surtout ces dernières années et les facteurs qui influencent leur succès, ont été examinés et analysés en détail. Dernières recherches menées par Deloitte (2014) soulignent que chaque année, en moyenne 50-70 drames sont télédiffusés, mais plus de la moitié d'entre eux sont éliminés après quelques épisodes en raison de la forte concurrence. Etant donné cet environnement concurrentiel, de faibles niveaux d'audimat provoquent l'abolition des téléfilms.

Lorsque l'aspect économique du sujet est considéré, il est clair qu'il y a plusieurs différents couts à envisager pour produire une série télévisée. Dans ce contexte, le cout principal consiste des salaires payés aux acteurs, au scénariste et au directeur. D'autre part pour atteindre des niveaux satisfaisants d'audimat, le facteur clé est la collaboration avec les célébrités, les acteurs populaires. Selon une recherche effectuée par Deloitte (2014), le montant à payer pour l'acteur / actrice constitue le poste le plus important des coûts dans le budget. Lorsque leur popularité augmente, le ratio du budget alloué aux joueurs dans le budget total atteint le 45%. En outre, une quantité considérable d'argent est investie aux réalisateurs et aux scénaristes. De plus, il faut envisager les coûts opérationnels et logistiques. Les sociétés de production déterminent le prix de leurs projets en

ajoutant aux coûts 20%-40% du coût total (Sözeri & Güney, 2011). Les agences de publicité ou les marques investissent dans ces productions offrant la possibilité d'accéder à de nombreux clients potentiels. Egalement les chaînes de télévision fournissent des revenus de cette façon. Chaque production échouée provoque des fissurations dans cet anneau économique. Une production échouée ainsi cause à la fois la perte des coûts d'achat et aussi la perte des revenus ciblées. Donc cette situation se reflète comme une grande perte dans le bilan. D'où, les prédictions précises sur le succès et l'audimat d'une production avant l'émission a une importance vitale pour tous les actionnaires de l'industrie.

Dans cette dissertation, les facteurs de réussite d'un drame de télévision ont été identifiés, analysés et modélisés en utilisant la technique des cartes cognitives floues. Ce modèle permet de surveiller l'impact des divers changements des facteurs de succès sur l'audimat en effectuant une analyse de scénarios et donc facilite la prédiction et la prise de décision.

Les Mots Clés : Les Séries Télévisées, Les Cartes Cognitives Floues, Les Facteurs de succès, l'Audimat.

ÖZET

Son yıllarda teknolojik gelişmelerdeki hızlı artışa rağmen, televizyon günlük hayattaki yerini korumaktadır. İnsanoğlu , televizyonu kimi zaman bilgi edinme aracı ,kimi zaman boş zamanlardaki arkadaş, kimi zaman günün yorgunluğundan ve stresinden kurtulmayı sağlayan bir araç olarak görmekte, böylece tüm diğer seçeneklere rağmen televizyon hala popülaritesini koruyabilmektedir.

Bu çalışmada, özellikle son yıllarda Türk televizyonlarında bir olgu haline gelmiş olan televizyon dizilerinin izlenme oranlarına etki eden faktörler detaylı olarak incelenmiş ve analiz edilmiştir. Son yapılan araştırmalar, her yayın dönemi başında ortalama 50-70 adet televizyon dizisinin yayına girdiği ve bu dizilerin yarısından fazlasının sadece birkaç bölüm gösterildikten sonra yayından kaldırıldıklarını göstermektedir (Deloitte, 2014). Kuşkusuz bu sonuca sebep olan durum dizi piyasasındaki yoğun rekabet ortamı ve yarışa dahil olamayan dizilerin düşük reytingler almasıdır.

Konu ekonomik boyutu ile ele alındığında, bir diziyi üretmenin belli başlı maliyetleri olduğu açıktır. Bu maliyetlerin başında oyunculara, senaristlere, yönetmenlere ödenen bölüm başı ücretler gelmektedir (Deloitte,2014). Bu maliyet kalemini dizinin çekimi için kiralanan mekanlar, kostümler, set çalışanlarına ödenen ücretler gibi lojistik ve operasyonel maliyetler takip etmektedir. Tüm maliyetleri göze alınarak üretilen diziler, belirli bir kar marjı eklenerek televizyon kanallarına satılmaktadır. Reklamcılar veya markalar da pek çok potansiyel müşteriye ulaşma imkanını sunan bu yapımlara yatırım yapmakta ve televizyon kanalları bu yolla gelir elde etmektedir. Başarısız olan her bir dizi bu ekonomik halkada kırılmaya sebep olmaktadır. Televizyon kanalları başarısız olan bir dizi için hem belli bir maliyeti göze alıp ürünü satın

almış, hem de istenen reytinglere ulaşamadığı için hedeflenen geliri elde edemediğinden bu durum bilançolara büyük zarar olarak yansımaktadır. Konu ekonomik boyutu ile alındığında bir dizinin içerisine gireceği rekabetçi ortamda başarılı olup olamayacağı konusunda öngörüde bulunabilmek sektörün tüm paydaşları için büyük önem taşımaktadır.

Bu çalışmada, bir televizyon dizisinin başarısını etkileyebilecek faktörler belirlenmiş, analiz edilmiş ve Bulanık Bilişsel Haritalama tekniği kullanılarak modellenmiştir. Ortaya çıkan model yardımı ile başarı faktörlerindeki çeşitli değişimlerin izlenme oranlarına etkisinin gözlenebileceği senaryo analizleri yapılmış, öngörüde bulunmayı ve buna bağlı olarak karar verme sürecini kolaylaştıracak bir çalışma yapılmıştır.

Anahtar Kelimeler : Televizyon Dizileri, Bulanık Bilişsel Haritalama, Başarı Faktörleri

1. INTRODUCTION

In recent years, although the use of internet and social media rises dramatically, the television is still the most common communication tool. According to latest research,in 2014, the average daily television viewing time per person in USA was 282 minutes (4.7 hours/day), in UK was 220 minutes (3.67 hours/day); in China 157 minutes (2.62 hours/day) (Statista, 2015). When it comes to Turkey, the latest research conducted by Marketing Turkey (2014) demonstrates that Turkish viewers spent avarage 4,42 hrs/day by watching TV in 2011 and this amount of time has increased to 4,57 hrs/day in 2012 and climbed up to 4,81 hrs/day in 2013.

As a nature result of this tendency, television broadcasting creates its own economy. Producing and broadcasting of a work to the audiences is a kind of process just like the production and delivery process of any product which requires the use of certain resources and eventually aims to make a profit. In this respect, television broadcasting is not only communication effort but also is an economic activity. As in other sectors, television industry also deals with the several type of costs and requires specific sources of income to reveal a product. The majority of the revenues in broadcasting business is obtained by advertising and sponsorship agreements. In Turkey, since the free-over-air type broadcasting is more common than the other options, television channels can not obtain a direct revenue from the audiences as in the cable television system. From this perspective the main objective of a television channel to create the products that can attract and magnetize the audiences who will be served to the advertisers.

Advertisers work between television channels and brands or consumption goods like a bridge. To reach more people and introduce the brands and goods to them is one of their main tasks. In this respect, to select the correct television

program which that can convey the product to the targeted audiences is quite important. The main factor determining the program that will be made an investment by advertisers is audience measurements. According to the size and the composition of the viewing which is known *rating*, advertisers purchase the time slots within the television programs, therefore get a chance to present the products to the potential customers while the TV channels obtain the required revenue. Since the television advertising time is purchased some months in advance (Katz, 2003), the predicted rating level of a new program has a vital role in the advertising investment process.

Today's multi-channel environment make the rating prediction process quite difficult. As the viewers have hundreds of channel options to watch, several numbers of program types are broadcasted on them. Due to the increased options, rating prediction process of a program become a challenge for all the shareholders.

Among all the viewing options, television dramas stand out with their high rating levels. This state make the television dramas most precious television product in the eye of the advertisers. As a natural result of this tendency, television dramas become one of the strongest contents that provide high revenue. Moreover, when the drama get success, it can be exported to the other countries and production companies or television channels-in case purchasing all rights of the product- can acquire a noteworthy revenue from the sales operation to the foreign countries as well. Therefore, television channels become more enthusiastic to make investment on television dramas. The latest studies indicate that, in 2013, television broadcasters allocated average 1342 hours/year for news, 1024 hours/year for actual programs, 1093 hours/year for cultural programs, 606 hours/year for educational programs 93.6 hours/year factual programs, 1062 hours/year for entertainment programs, 571 hours/year for children programs and the 1333 hours/year for television dramas. (RTUK, 2014). It can be inferred from the figures that the television dramas have the widest time period after the news.

In last decade there is an tremendous increase in the television dramas on Turkish televisions. This intensity inevitably leads a severe competitive environment among television dramas. The research conducted by Deloitte (2014), points out; average 50-70 television dramas are released each year but more than half of them is removed after a couple of episodes are shown on the television due to the severe competition. Television channels that purchased the drama failed to obtain the desired rating level, both venture purchasing costs for a unsuccessful product and fail to achieve targeted revenue and this situation reflects as a great loss to the balance sheet. When the financial aspect of the subject is examined, to predict whether a television drama achieve high rating level before it is released has a vital importance for all the shareholders of the industry.

The aim of this study is to identify the success factors which make a television drama successful, longevous and analyze them for further prediction process. There are many variables that can affect the success of a television drama. While some of the variables and their affects are measured up quantitavely , most of them are only expressed with in a qualitative manner. This structure of the success factors make the prediction process more difficult and complex. To deal with these uncertain and unpredictable nature of the case, Fuzzy Cognitive Map approach which is well suited for this kind of problem is chosen.

FCM is appropriate for the cases which suffer from the data limitations. As it can be observed for our subject, it is quite difficult and costly to get useful data for the research. FCM is not an aproach based on parameter estimation, it allows to analyze the system with qualitative information and this property of FCM facilitates pattern recognition and changes in the behavior of the model and simulations can be done to learn how the model changes with changing strenghts of relationships (Özesmi & Özesmi, 2004). Thus variables that can only be expressed with in qualitative manner can be taken into account to see dynamic behavior of the model. Because, FCM allows to express and grade the variables

with the qualitative degrees like “some”, “a lot” “medium” etc. FCM is easy to build, understand and analyze. With the knowledge aquisition procedure, FCM allows to compile different opinions about each variable affecting system behavior from the all shareholders of the subject. Overall, it is a suitable approach for knowledge aquisition and evaluation.

When the previous studies are examined, it is seen that most of them consist of distributional and seasonal models which apply time series methods to predict the rating of a program. They are usually built on historical data and produce solely technical forecasts. However, as it explained before, there are various determinants affecting the rating of the programs. The previous studies normally consider seasonality, content classification in the form of programme genres as well as the content of the competing programme and the programme surroundings but the details about the definition of the competing programme or about the content classification are always missing (Weber, 2002). Moreover, external effects such as social media, launch effect etc. significantly affect the viewing of the program. But , none of them are taken into account for the technical rating forecsting studies. To deal with the shortcoming of the previous rating studies, it is realized that there is a necessity to exhibit and analyze the all success factors affecting the rating of a programme. Particularly, television dramas becoming television phenomenon have been chosen for the searching area. As far as we know, this study is the first attempt that aim to analyizing and modelling the success factors of a television drama bu using Fuzzy Cognitive Map.

This thesis is organised as follows.Section 2 gives a brief information about the place of the television in the daily life, economic aspects of television boadcasting and audience measurement. Section 3 focuses on television drama and its importance for the Turkish televisions. Section 4 reviews the previous rating forecasting studies. In Section 5 explaines concept of the FCM and the properties, construction procedure of FCM . Section 6 presents the proposed model in detail. Section 7 includes the scenario analyses that allow to observe the

dynamic behavior of the system. Finally ,Section 8 of the paper discusses the results of the approach and evaluates the contribution of the study to the field.

This study attempt to answer this questions:

1) What are the main success factors affecting the rating of a television drama?
2) How do the changes in the success factors affect the behavior of the system?
3) What are the strengths and the weakness of this FCM based model?

2. THE PLACE OF TELEVISION IN DAILY LIFE

As it is noted in the introduction section, this study aims to identify critical success factors and their effects on the success of the television dramas by using fuzzy cognitive map technique. To get a better sense about the study, it is required to emphasize triggering motivationsof this research study. For this purpose, before giving detailed information on the application process, socio-economic aspects of television viewing and broadcasting will be briefly explained.

2.1. The Function of Television

In recent years, although the use of internet and social media rises dramatically, the television is still the most common communication tool in every segment of society. Though the effects of television on individuals are debated for years, it should be accepted that the television has become the indispensable part of our lives and has managed to save its place despite the develeloping technology and changing multimedia environment. When the significance of the television in human life is considered, we have to focus on all type of audiences from ones who lead a strenuous life in a cosmopolite cities to those who live within peace in a rural cottage. No doubt the role of the television for both segments is quite different from each other. Up to date, several studies have been conducted to understand the place and purpose of television viewing in daily life of human beings. Jennifer Bryce (1987) has inspected the time spending effect of television viewing and the reflection it to the families' time organizations (Gauntlett &Hill, 1999). Rogge (1991) has focused on the function of television which creates an emotional and communicative atmosphere in the family. Gauntlett& Hill (1999) have done a detailed research to be able to reveal the different motives to watch televisions. In his study, the individuals selected

homogeneously were asked to write their typical day and the obtained outcomes were observed to understand how television fits in the people's life and how it incorporates in other daily activites. When some examples from diaries were examined, the most conspicuous diagnosis is that the television viewing habit varies up to the changing needs of individuals according to their socio-economic status, sexes, ages etc (Gauntlett & Hill, 1999). Whilst some of the audiences need it as a means of relaxation, some of them especially who are living alone benefit from its companionship and some others merely use it to learn the weather reports to be able to decide how to dress before leaving home.

Television is not only perceived as a means of getting information, relaxation or as a good friend. On the other hand it is accused of blunting intellectual and social skills of individuals especially children. There have been several studies which focus on this effect of television on individuals. A study by Gunter and Winstone (1993) found that 90 per cent of their respondents thought parents should encourage their children not to watch too much television. Barwise and Ehrenberg (1988) and Kubey and Csikszentmijalyi (1991) reported that audiences can feel guilty about watching too much television, however such feelings were not especially powerful, as eventually people still chose to watch television (as cited in Gauntlett& Hill, 1999). McQuail (1997) pointed out that the audiences have a great concern for the time passed with television viewing and hence they feel guilty. As it is not considered as a productive activity, parents are advised to control their children's television viewing habits and the time spent in front of it.

It is obvious that television has different meanings to each individual. It is possible to list all all purposes of television viewing but generally speaking it can be said that the people watch television to meet some certain needs. These requirements have been collected under the certain categories, thus, Uses and Gratification Theory (U&G hereafter) has been developed. U&G basically focus on the needs and expectations of individuals from using media. This theory tries to find the answer for the question of *what people do with media* contrary to the traditional discusses on *what media do to people.* It is seen as an

audience-oriented approach. Early studies investigating the needs of media usage are insufficient not only technical perspective but also in terms of their conceptual structure. Katz et al.(1973) has listed five basic sociological and pyshcological needs satisfied by media usage: Cognitive Needs (for obtaining information and knowledge), Affective Needs (for emotional, aesthetic experince), Integrative Needs (gaining of self-confidence, stability and status), Social Integrative Needs (connecting with family, friends ,social environment, establishing the companionships, finding common points with others), Tension Release Needs (escaping from the stress and the daily routine life, relaxation). Over the years, tendency of human being to watch televison has significantly increased to satisfy the mentioned needs.

The growth in the number of households with a television is one of the most important proofs of this increased tendency. When Figure 2.1 is considered, substantial increase in the television popularity through the years can easily be observed. When it is evaluated from the historical point of view, the households with a TV set has increased year to year, as the prices have fallen. This situation made the availability of television easier and the dramatic increase has continued to the present. It is estimated that there were 1.4 billion households with at least one TV set globally by the end 2012, corresponding to 79 per cent of total households and around 95 million new households with a TV added between 2008 and 2012 (ITU, 2013). This result clearly proves that, although, rapidly changing technological environment and introduction of new digital platforms to human life, TV has saved its place and has maintained its expansion.

In the developed world, virtually all households had a TV by 2008, while in developing countries 69 per cent of households had a TV. In the four-year period between 2008-2012, biggest growth is observed in the developing countries, with the addition of 87 million more households with a TV, thus reaching 72 per cent of households with a TV by 2012. This is relatively high proportion compared to the share of a computer (50 per cent) or Internet access (47 per cent) in developing countries represented in the world's total (ITU, 2013). Another

interesting point, in developed countries,where the margin of growth was limited, there is no change in the TV popularity despite the today's digital era.

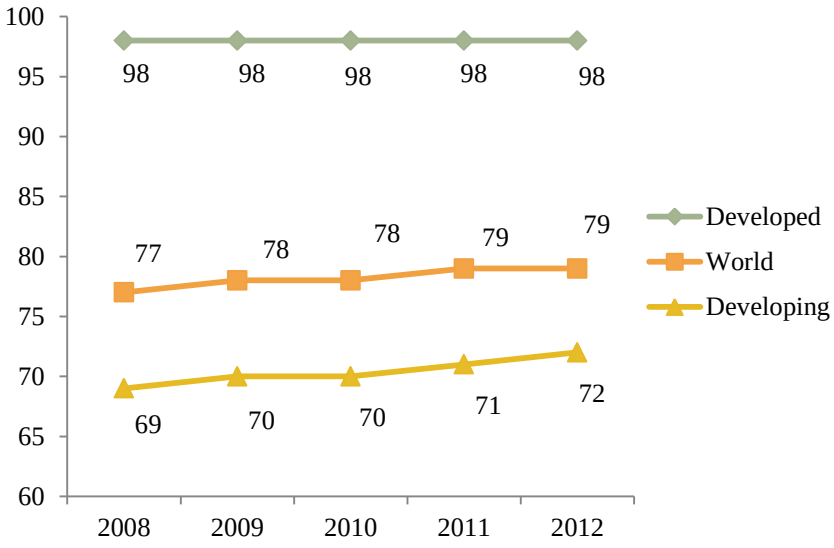


Figure 2.1: Households with a TV, World and by Level of Development, 2008-2012 (ITU, 2013)

On the other hand, around 349 million households in developing countries did not have a TV by the end 2012 (ITU,2013). Vast majority of the people who can not watch TV in their living rooms lives in Africa. The limited TV ownership in Africa can be analysed with several factors but it is possible to say that the limited electricity access is one of the most important reasons. Fewer than 25 per cent of households in Sub-Saharan Africa have access to electricity (AFREA,2012). In recent years,by the provided initatives for entrepreneurs, several investments have been made to increase the access and consumption of electricity. Accordingly, the percentage of households with TV is expected to rise in the future. The biggest growth rate between 2008 and 2012, with 18 per cent, confirms all the theories above. Despite the rapid technological developments,new communication tools has been introduced in the daily life of

human being and there is no decline in the penetration of TV to the daily life. When the situation is evaluated globally, it is seen that almost 80 per cent of households worldwide had a TV by the end 2012.

Naturally, as any product purchased in this volume, television also creates its economy. Producing and broadcasting of TV program to the audiences is a kind of process just like the production and delivery process of any product which requires the use of certain resources and eventually aims to make a profit. In this respect, television broadcasting is not only communication effort but also is an economic activity. In next section, to get better understanding of the economic aspect of the television viewing, the process of broadcasting and financing any TV programs will be explained in detail.

2.2. The Economics of Television Broadcasting

According to well-known Adam Smith's theory, an ecconomic structure is built on three main factor: Land, labor and capital. From this standpoint, likewise other companies, media companies, too, create content and service (need equipments, land and raw material for this creation process) and employ people (labor) to create, sell and supply the content, requires capital (revenue) to do all. It is possible to categorize the costs as production and distribution costs. Undoubtedly, media industry can solely handle these costs by drawing attention of high volume of audiences and obtaining high advertising revenues.
In public service and other not-for-profit media, producing information useful and interesting programs for audiences is the primary function. However, in commercial media, however, the primary function shifts to producing audiences for advertisers or to making sales of media products to customers to obtain financial revenue for continious operations and profits (Picard, 2011).

The first- most obvious-of the products that media industries provide is content. As a public good, media content is not "used up" in consumption. Consequently, media firms can sell and resell the same media product indefinitely without

incurring additional costs (Napoli, 2003). The second product is audiences. Media firms produce content, then either give this content away or sell it in order to attract audiences. Media companies sell these audiences to advertisers that are seeking the attention of potential consumers of their products or services (Napoli, 2003). Simply, they simultaneously sell their products to two different markets. These characteristics that make the media industries so special demonstrate the properties of dual market economies. In their study Owen and Wildman (1992) clearly expressed this feature of the market as :

> " The first and most serious mistake that an analyst of the television industry can make is to assume that advertising-supported television broadcasters are in business to broadcast programs. They are not. Broadcasters are in the business of producing audiences. These audiences, or means of access to them, are sold to advertisers. The product of a television station is measured in dimensions of people and time. The price of the product is quoted in dollars per thousand viewers per unit of commercial time, typically 20 or 30 seconds."

The majority of the revenues in broadcasting business constitute the advertising revenues. Particularly, as mostly preferred in Turkey, in free-over-air broadcasting television business, there is no direct revenue derived from audiences. All the revenues are obtained from the selling the audiences to the advertisers. Conversely, the economic structure of cable television systems rely on the fees derived from subscribers. It is obviously seen that advertising incomes have a vital role for the profitability of media companies. To provide profitability, the main purpose of the contents broadcasted is to attract people/audiences' attention to the advertised product. From this perspective the success of a media company depends upon the ability of intoducing the content that magnetizes the audiences. Thus, the advertisers can reach more people and invest more money the for content. From this point of view, it would be beneficial to mention the economics of the advertising and the relationship between the advertising and the television broadcasting. To do this, in the next chapters, advertising spendings will be evaluated in the global manner and the details of the industry will be given in detail.

2.2.1. The Economics of Advertising

The main philosophy behind the advertisements is to familiarize the products or services to the customers within a competitive market structure, to persuade them to buy the products by gaining their confidence and by raising their awareness, in turn, eventually to promote the sales and the value of brand. Moreover, advertisements play a significant role on shaping the demand that occurs for products that are nearly the same to each other. Therefore, advertising enables the producers to control their own product in the market place. This approach provides the advertisers the sustainability of their existing market position. Advertisement companies are not different from the other companies which have the goal of maximizing profits, thus, to survive. From this point of view, they have to contend with some sort of operational and manageral costs as other firms do. In this point, media companies get involved and serve their needs and desires and cover their costs. With the ability to reach broad range of audiences, media companies provide to advertisers, the targeted customers who are potential consumers of the concerning product. The relationship between media firms and advertisers transform into a sort of mutualist life form.

Over the last 50 years an increased willingness of firms to invest in creating awareness of themselves and of their products has given rise to the rapid development of the advertising, marketing and public relations sectors (Doyle, 2002). The latest ZenithOptimedia predictions indicate that the global advertisement expenditure will grow 4.9% in 2015, reaching US$545 billion by the end of the year (ZenithOptimedia, 2014). While, in 1990s, the main advertisement platforms were television, radio, outdoor, press; with introduction of the internet to daily life and the expansion in the digital media has dramatically changed the media environment and influnced the economics of adevertising. It is suggested that around US$7.5 billion was spent globally on internet advertising in 1999 (as cited in Doyle, ZenithOptimedia, 2001:115). The latest report shows that US$ 56 billion of global advertising spendings consists of

internet advertising expenditure (ZenithOptimedia, 2014). This example distinctly proves how the balances in the advertising industry changes over the years. However, the television is still the dominant field for the advertisers. According to Figure 2.2. in 2014, the lion share belongs to the television with 39.6%. Television's market share has grown steadily over the last three and a half decades, from 29.9% of spend in 1980 to 39.6% in 2014 (ZenithOptimedia, 2014).

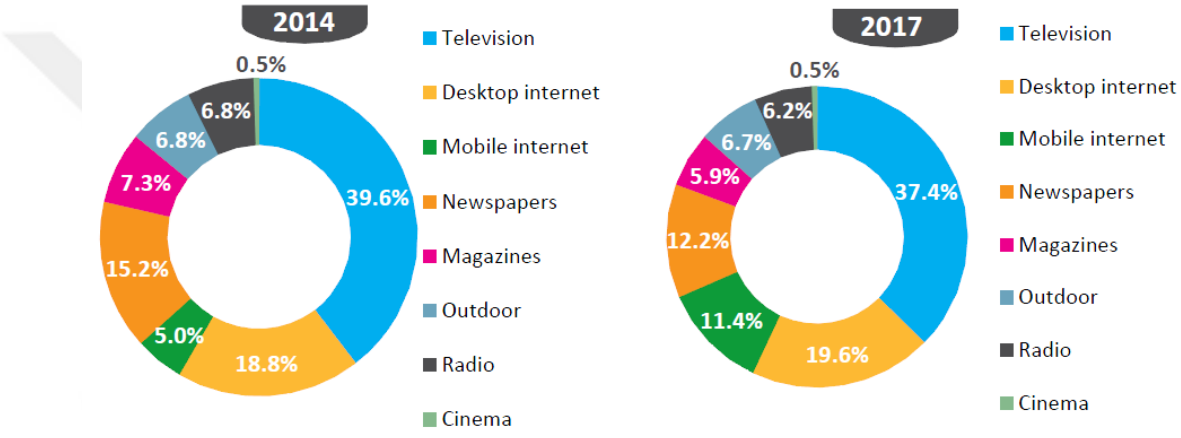


Figure 2.2. Share of Global Adspend by Medium (%) (ZenithOptimedia, 2014)

In 2017, since drastic increase in the desktop internet and mobile internet advertisement spendings is foreseen to continue but a slight decrease to 37.4%. is expected in the television advertising. Despite the changing shares, it is easy to say that the estimations for 2017 shows that the television will continue to dominate the industry.

In recent years , most scholars and the researchers working specifically on the topic, indicate that adspends as % of Gross Domestic Product (GDP) is a better measure of the health of the advertising industry than raw adspend data, which does not take into account the inflation (FAR, 2014). Gross Domestic Product

(hereafter, GDP) measures the total value of all productive output in the whole economy, usually over a one year period and is probably the most widely used benchmark of general economic performance. When expenditure on advertising is calculated as a percentage of GDP, the pattern that emerges indicates that as the national economy has grown over time in real terms, advertising has not just grown in parallel, but it has grown even faster. So the amount of advertising activity in an economy is related to the size and growth rates of the economy itself (Doyle, 2002). Moreover, the indications of adspend show the level of national welfare. In his study Nayaradou (2006) proposed four mechanisms by which investment in advertising communication has an indirect or direct , but unquestionable, impact on economic growth. Simply, these mechanisms are clarified with the following expressions:

1 Advertising stimulates the *growth of consumption.*
2 Advertising speeds up the *spread of innovation.*
3 Advertising promotes *competition*
4 *The dynamism of the advertising sector* enhances the growth of the economy
All these components have a positive impact on the global economy. Therefore, advertising industry is one of the most affected sectors by the economic crisis.

Several reasons, such as government restrictions in ad spendings, economic recessions can lead the decrease in the rate of advertising spendings or vice versa economic boom can occur and the increased purchasing power can cause a leap in the level of consumption. Clearly, people who have a purchasing power can only be interested in a new product advertised and do not zap them. Thus, the producers spend money on advertising as much as their restrained bugdet allows. The growths or declines on advertising spendings can be originated from global events as well. Global advertisement spendings has increased 3.6% in 2011 whereas this rate had reached 7% in 2010 with the effects of FIFA World Cup and Winter Olympics (PwC, 2012). However, these reasons can ultimately be based on national economic welfare. If everything is good in terms of national economy, companies can afford to create more budget for advertising

expenditure. Conversely, under the pressure of the economic crisis, the budget appropriated for advertising expenditures is the one of the first items which are sacrificed.

2.2.1.1. Advertising Spendings in Turkey

When the advertising spendings in Turkey are examined, it can be said that the factors which affect the advertising spendings globally are also effective for the market of advertising in Turkey. As Sözeri and Güney (2011) indicated in their study, the advertising revenues displayed a 50% decrease -which is prodigious for the industry- from one billion dollars to five hundred million dollars in 2011. With the increase in the advertising revenues in 2002, media sector has revived and become an engaging area for the investors again. This increase continued incrementally until 2007. In the second half of the 2007, global economic crisis has cropped up one more time, and its effects reverberated to the advertising spendings in Turkey. As indicated in the Figure 2.3., while economic growth rate decreases dramatically between 2007 and 2009, advertising spendings displaying a positive correlation with the economic growth decreases susbstantially as well. This downtrend reaches 15 % in 2009. In 2010, with the diminution in the effects of the economic crisis, the industry has experienced a recovery, the advertising spendings has shown a step-up with 35%.

On the other hand, the ratio of advertising spendings to GDP, another significant indicator, is essential to interpret in terms of the relationship between economic growth and advertising spendings. When the Table 2.1 is analyzed, according to global or national economic nature, GDP changes in the increase or decrease direction time to time within ten years, but the ratio between advertising spendings and GDP has reached at most 0,5% in 2000.

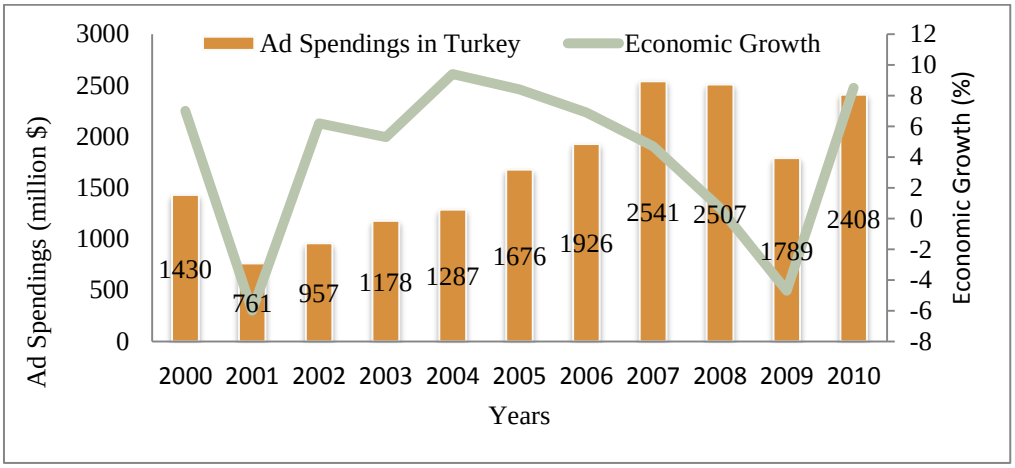


Figure 2.3: The Growth in Advertising Spendings and GDP in Turkey

Through the years, in spite of the increase in GDP, any considerable increase has not occured in the ratio between advertising spendings and GDP. This pattern proves that most of the companies in Turkey still allocate little or no money for advertising (Sözeri & Güney, 2011).

Table 2.1. The Growth in Advertising Spendings and GDP in Turkey (Sözeri & Güney,2011).

	Currency	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Ad Spendings in Turkey	Billion TL	892	932	1.441	1.759	1.831	2.248	2.756	3.308	3.241	2.767	3.613
Ad Spendings in Turkey	Million USD	1430	761	957	1178	1287	1676	1926	2541	2507	1789	2408
The Growth in Ad Spendings	% (USD)		-46,82	25,82	23,11	9,27	30,22	14,89	31,92	-1,34	-28,64	34,63
GDP	Billion USD	266.439	195.545	232.28	303.262	392.206	482.685	529.187	649.125	729.443	614.47	729.05
Ad Spend in Turkey/GDP	%	0,5	0,4	0,4	0,4	0,3	0,4	0,4	0,4	0,3	0,3	0,3
GDP per Capita	USD	8.168	7.747	8.224	8.705	9.844	11.006	12.107	12.901	13.124	12.466	13.392
Economic Growth	%	7	-6	6,2	5,3	9,4	8,4	6,9	4,7	0,7	-4,7	8,5

Although digital platforms and the internet continue to enter into the daily life of human being, television still maintain its leadership when the distribution of advertising spendings are examined (Figure 2.4). One can affirm that the

percentage of television advertising spendings has never decreased under 50% since the 2003. Another important point is the incremental increase in the internet advertising through the years. The incrase in spendings on the internet advertising leads to gradual decrease in the other fields such as newspapers,radio and magazines. The reason behind the leadership of television is that television viewing rates are quite high ,as a result of this case, the television has the strongest capability to affect the public occurs. Another noteworthy reason is that, since the competitive environment of the television industry, advertising prices are relatively lower to the other fields. (Sözeri & Güney, 2011). According to RTUK (2014) report; 205 local television, 17 regional television and 24 national television companies serve in the terrestrial broadcasting. That give an idea about the dimension of the severe competition in the industry. Moreover, the surveys conducted by RTUK, shows that 139 cable televisions and 293 satellite televisions perform broadcasting as of the end of 2013. (The number of cable television was 77 and satellite television was 139 in 2009) (RTUK, 2014). As the inevitable result of this case, increased numbers exacerbate the competition day by day. TESEV (2011) research emphasizes that although, almost 30% of advertising demand is rejected by broadcasters, there is no growth in advertising revenue because of the competition among themselves (Sözeri & Güney, 2011).

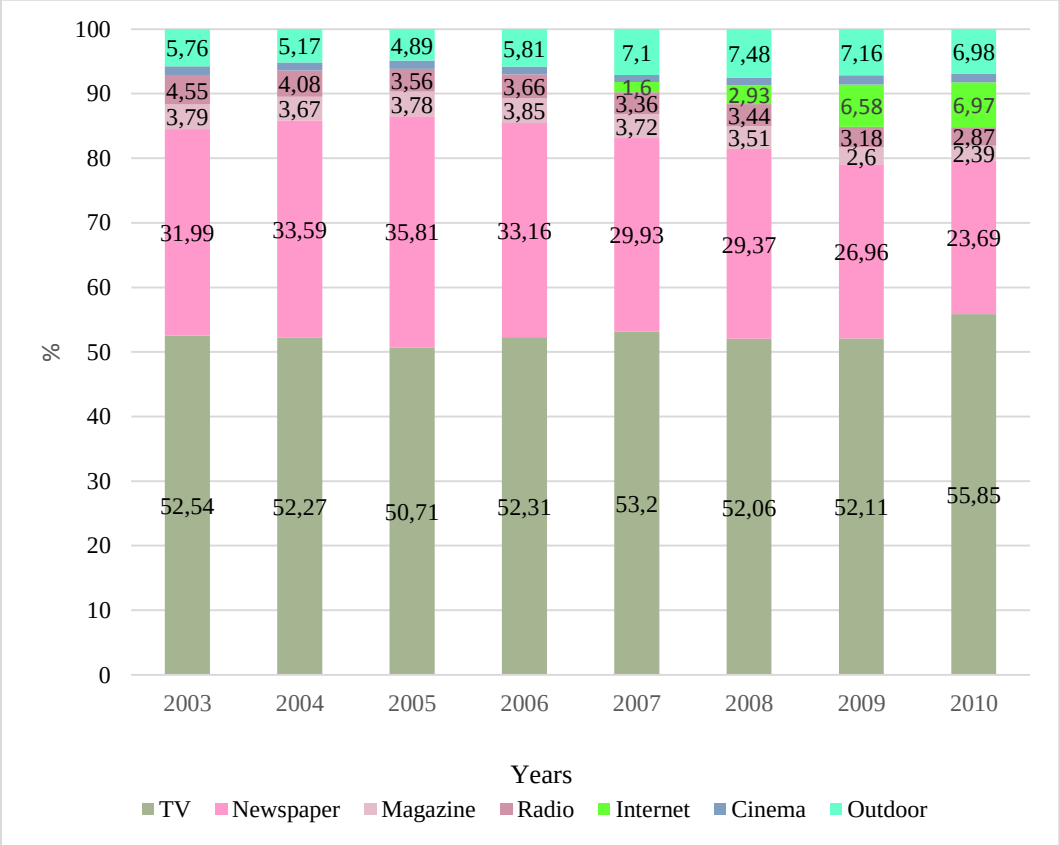


Figure 2.4: Share of Advertising Spends by Medium in Turkey (Reklamcılar Derneği;Sözeri & Güney, 2011)

To sum up, television is still most preferred area for the advertisers but when the advertising revenues obtained in the television business in Turkey are compared with the selected countries, the place of Turkey remains in the background (Figure 2.5)

In global sense after examining the advertising spendings and the position of Turkey in this regard, advertising expenditures made for television and the factors that affect the selection procedure of the stakeholders, it would be useful to explain how the process works in order to understand the importance of the issue in terrms of our research topic.

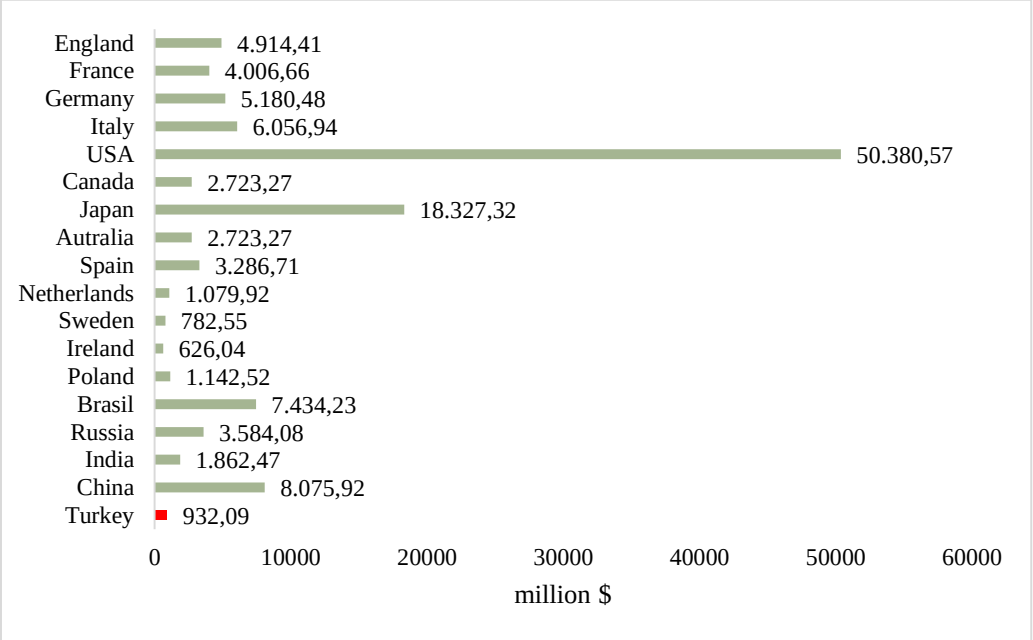


Figure 2.5: Global Tv Advertising Revenues in 2009 (OFCOM; Bilgili,2011)

The advertising industry consists of four principal entities: Advertisers, Agencies, Media and Suppliers (Thakor, 2012). In his study Shaver M.A.(2004) suggested that there are two basic audiences for advertising. The first is the consumer audience that is exposed to the advertising through many types of media means. The second are the manufacturing and service organizations who use advertising to make contact with the audience and potential consumers to present their goods and services. Generally, the advertisers who aim to contact with the targeted audiences apply the advertising agencies. Advertising agencies carry out research and surveys on the product, its targeted consumers and the other competitors, take necessary brief from the advertisers, basically try to recognize the market place of the commercialized product. With the assistance of its creative and technical team, agencies, bring out the advertisement and present it to the consumer by the channels of media. Applied media channels can be classfied according to the product and the targeted consumers. In 1996, McAllister stated the advertisers determine the best media channels that can

convey the product to the targeted audience according to following criterias (Hızal, 2013):

1 *The Size of Targeted Audience*: As long as the share of viewing rises , the level of advertising increases. This pattern triggers the increment in the advertisements tariffs of the media.

2 *The Structure of Targeted Audience*: Advertisers specifically aim to reach the consumers who have similar/homogeneous characteristics in terms of demographical (age, sex, socio-economic status,educational status), pychological, cultural perspectives.

3 *The Sensivity of the Targeted Audience:* Advertisers desire that the content of the advertisement create an atmosphere for the customers that can take the message and and be coinvinced. This criteria is also effective on the process of media channel selection. To simplify, for an advertiser which try to commercialize the household appliances, to buy a certain length of time within a cartoon whose audiences generally consists of children will be a meaningless attempt. Instead of this effort, *Desperate Housewives* that generally viewed by adults, especially women, would be a more logical investment. It is obvious that the segment involves women more valuable than the one consists of children, since the women are more likely to buy and consume the mentioned product compared with children.

In this regard, agencies can be evaluated as the bridges between the advertisers and the media. The advertising industry relies on two sources of income to function successfully. The first, which directly supports advertisers, is income from consumers, who buy advertisers' products and services. Advertisers to hire agencies then use that income and the second major source is from the media (Thakor, 2012).

Payment structure in the advertising industry is established on the both. Most common one is *comission system*. In this structure, when an advertising agency places an advert for a client, the medium (e.g., newspaper, TV, radio) pays a commission to the agency. If, for example, the commission rate is 15% and an advertisement costs $1,000, the advertiser pays $1,000 to the ad agency. The

agency remits $850 to the medium and retains the remaining $150 as its commission. Thus, the commissions that an agency receives pay for the services it provides to the advertiser (AdAge, 2003). Another model, one that is becoming more common, is that the agency charges the client *a fee based* on the nature and amount of the work. The agency may be paid a flat fee for the basic work and additional fees for additional work such as promotions, logo design. The client might also be charged a flat fee for the time expended on the work with the cost of production and time and space costs added (Shaver, 2004). One other common one is *payment by result.* This involves measuring effectiveness of advertising campaign using marketing research. Payments might be based on how awareness level has increased, brand image improved, or intentions to buy risen and in terms of media buying (Kumar & Meenakshi, 2006).

Advertisers need information in order to select media or a combination of media in which to advertise; the specific channel(s), station(s), newspaper(s) and/or magazine(s) to use; what type of messages or content to convey; and the best time, frequency and/or methodology to convey their messages and advertising agencies act on behalf of advertisers or sponsors in order to provide specialist advice to their clients, they also need detailed information on audiences for all the media (Bornman, 2009). At this point, need of "audience measurement" occurs. In the next section the subject of the "audience measuremet" will be briefly explained. Before explaining role and the importance of the audience measurement, the competitive environment of television broadcasting in Turkey will be given in detail.

2.2.3. Television Broadcasting in Turkey

In this section, specifically, the short historical process that Turkish television industry has undergone will be clarified.

In Turkey, the first broadcasting attempts have been exprienced in 1952-1953 academic year in Istanbul Technical University (ITU) but since there is not enough receiver at those times, these efforts sustained in the studio environment

(Tanrıöver, 2012). After legitimate regulations in 1964, TRT (Turkey Radio Television Institution) started broadcasting 31 January 1968 (Yağcı, 2011 & Tanrıöver, 2012). The issue of television broadcasting continued with the dominance of TRT until private broadcasting starts to develop in 1990s.

Private broadcasting started with the trial broadcasts of Star 1 in March 1990 by the company Magic Box-MBI Movie and Advertisement AS, affiliated with Rumeli Holdings, owned by the Uzan family. Almost all the organizations that have a market share in today's TV landscape started broadcasting before 1994 (Adaklı, 2009). In 1990s, the institutions which invest in the media sector, have managed to grow up rapidly with the assistance of government initiatives. The structure of ownership is controlled and dominated by five big capital groups Doğan, Bilgin, Aksoy, Ihlas and Uzan that became private monopolies, radically changed with the ambitious entry of the newcomers, namely Dogus (Sahenk Family), Çukurova (Karamehmet Family) and Park (owned by Turgay Ciner)(Adaklı, 2009). It is necessary to indicate that mentioned ownership structure has occassionally changed according to the political and economic situation. For example, Doğus Holdıng was one of the corporations that transform the economics crisis into the opportunity in 2001. In spite of the economic distress in those days, Cukurova Holding was another organization which could achieve to maintain its existence up to date. Today, even though , Cukurova Holding tries to contend with its decreased shares in the telecominication sector and the issues with the foreigner partners, it is still one of the actors of the industry. The Uzan Group has also faced with the bankrupcity which emanated from the economical ve political disaggrements because of the commercial conflicts with Motorola and the political initiatives of the owner of the Uzan Holding and all the media companies of the group has been handed over (Dagtas, 2013). On the other hand, Dogan Holdıng case is a stunning example to explain how the political relations can be effected on the economic balances of the media holdings. In 2009, after Dogan Holdıng has been fined 3,8 billion Turkish Liras tax penalty, it has to sell "Milliyet" and "Vatan" with the participation of "Karacan" and "Demirören" in 2011. From this standpoint, it is hard to say that

Dogan Holdıng sustain its former authority in the sector (Dagtas, 2013). Although during the 2001 economic crisis, from journalists to the genaral managers of the television channels, many employees of the sector had to face with unemployement, when the today's television environment is examined, it can be easily said that the effects of economic crisis has been overcomed. According to RTUK (2014) report; 205 local television, 17 regional television and 24 national television companies serve in the terrestial broadcasting. Moreover, the surveys conducted by RTUK, shows that 139 cable television and 293 satellite television perform broadcasting as of the end of 2013. (The number of cable television was 77 and 139 for satellite in 2009) (RTUK, 2014). This figures give an idea about the dimension of the severe competition in the industry. It could be said that when the number of channels were being expressed with the number of a hand, audience measurement was not a significant issue since there were a few viewing options; but today, the number of the channels are expressed with the hundreds, this situation promotes the competition among the television channels and the make audience measurements significantly important. At this point, giving a brief explanation about the audience measurement would be beneficial.

2.3 . Audience Measurement

Audience research − and audience measurement in particular – has become much more than merely satisfying the curiosity of broadcasters about their unseen audiences (Webster et al 2006). The size of the audience is the primary data that effects the advertising revenues obtained by broadcasters and the level of the time gaps purchased within the content by advertisers. As Bornman (2009) indicated in his study, media owners typically operate in two different markets: the market of audiences for their particular media products, and the market of advertisers to whom they hope to sell advertising opportunities for communicating with potential customers and they need to coinvince advertisers that a selected content will reach a particular audience in terms of both size an composition.

To get a better understanding about the subject, it is essential to understand some common terms that are used to express the size and composition of audiences. In order to prevent from any confusion, some frequently used terms to express this phenomenon, will shortly be explained. In this regard, mainly, the terms of *Gross Rating Points (GRP), Avarage Time Spent (ATS), share* and *rating* will be explained.

According to definition made by Nielsen, Gross Rating Points (GRP) is predicated as sum of all ratings for all programs in a schedule. One another point of view by Webster et al (2006) GRPs provide a crude measure of audience exposure to commercials over the course of a media campaign and advertisers use them before a buy to estimate the total audience they want to reach, and they calculate actual GRPs after the campaign to determine whether it was successful. The reason these rating points are considered "gross" is that they do not take into account any duplication of exposure (Katz, 2003). To make it clearer, the following Table 2.2. and calculations will be useful.

Table 2.2. Estimation of GRP for Three Different Channels (Güler, 2011)

Show	Rating (%)	Number of Spots	Total
A	15	2	30 GRP
B	10	5	50 GRP
C	5	2	10 GRP
Total Weekly GRP			90 GRP

One another concept is Avarage Time Spent (ATS), refers to the average viewing time of the audiences in a certain time interval (Table 2.3). When the Table 1.3 examined, Channel X is viewed by two people within 19:01-19:03 time interval. A views the channel X three minutes, and B views 2 minutes. Nonetheless, total viewing time 5 minutes of Channel X, average time spent on this channel is 2.5 minutes. The case for Channel Y can be interpreted in a similar fashion. When it

comes to estimate average time spent on television viewing, as it can be seen in last column on the Table 2.3., total viewing time of the channels is summed and the obtained value is divided into the total number of viewers. In the end no matter which channel is viewed, the average time spent on television viewing which is 1.8 minutes is achieved.

Table 2.3. The Estimation of ATS for Two Different Channels (Güler, 2011)

Time Interval	Channel X	Channel Y	Total
19:01-19:03	A: 3 min. B: 2 min.	B: 1 min. C: 1 min. D: 1 min. E: 1 min.	A: 3 min. B: 3 min. C: 1 min. D: 1 min. E: 1 min.
19:01-19:03	(3+2)/2=2.5 min.	(1+1+1+1)/4=1 min	(3+3+1+1+1)/5=1.8 min

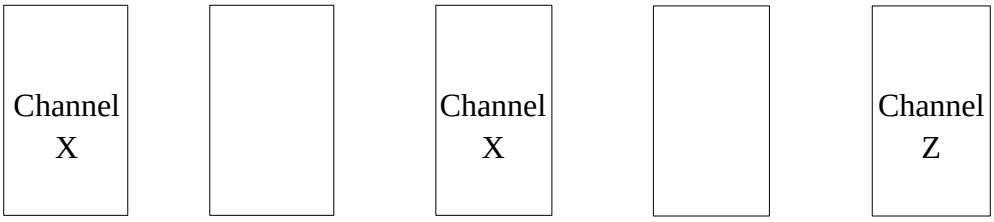
Although the terms of *rating* and *share* are used as if they are in the same meaning , actually the purpose of their use is quite different from each other. In this part, the main characteristics of these concepts and the difference between them will be explained.

Webster et al (2006) in their book stated that the ratings are the most frequently used descriptors of audience size and defined the rating is the percentage of households or people tuned to a particular station. To make it clearer, rating is the ratio of television channel tuned in to the total television households. It does not matter whether television is switched on or off. Since the total number of television in the houses is taken into account, the value in the denominator does not change for different times of day or for different programs of television channel. When it is expressed that the television show " Come Dine With Me" received 23.8% rating , it means 23.8 of all houses have tuned in that program. In his study Katz (2003) touches upon that audience can be defined in various ways- by household, by geographic market, by a given demographic group, such as men

18 to 49 or women 25 to 54, or any product usage or ownership. In this case, the number of denominator can be the number any specific targeted group. For example, 8.3% of all single women live in London watched the "Nigella Lawson's Kitchen", means the denominator is the number of the single women who live in London. Whether their television is switched or not does not matter in terms of rating measurement. One another definition for rating by Guler (2011), one rating point is an indication of the percentage of probability of exposure a group of people to a program or advertising messages.

On the other hand, share is defined as the ratio of television channel tuned in to the number of households using television for a certain length of time (Webster et al, 2006). The most important difference between rating and share is the switch on situation of the television. Similarly , this term can be portrayed as a kind of indicator of competition of the aired programme. Because , the share; expresses the power of the program among the other aired programs at the same time. This model facilitates to comparison as well.

To explain the difference between rating and share the following Figure (2.6) and the related calculations will be beneficial.



Rating of Channel X= Households Tuned to Channel /Total TV Households
Rating of Channel X= 2/5 (40 %)

Share of Channel X= Households Tuned to Channel/Households Using TV
Share of Channel X=2/3 (66.6 %)

Figure 2.6. The Difference Between the Share and Rating (Webster et al, 2006)

As it can be observed that the share of a channel (or program) can be different from the rating of it. This case mostly emerge in the time periods when the total viewing is very low like early in the mornings. Guler (2011) indicated that; while the share of a program broadcasting early in the morning is 30%, the rating of this program can be 3%. This pattern allows the channels better atmosphere to be able to compete. Although, small number of viewers are involved in this model, the programs broadcasting within this specified time schedule has a higher capacity to compete with the other programs within the same schedule. This structure makes the share of the program more vital than ratings of it as long as the program is aired in these type of time periods. In fact, unless everyone is using the medium at the same time, a program's share will always be larger than its rating. It should also be apparent that shares, by themselves, give you no indication of the absolute size of an audience (Webster et al, 2006). According to Beville (1988), audience ratings are powerful force within the media industry that determine the price of a particular programme and important factor determining the price that advertisers will be willing to pay for advertising time in and around the time that the programme is broadcast (as cited in Bornman, 2009). In this point , it is essential to respond the question of *how much does it cost to reach the targeted audiences for advertisers?*

There are two common calculations to estimate the price of the time gap between the programs. One of them is *Cost Per Thousand* (hereafter CPM , M comes from the Roman numeral for 1,000) shows the cost of reaching 1,000 of the target audience either with an individual media vehicle or the complete media schedule (Katz, 2003).

CPM= (Media Cost /Gross Impression) x 1000

For instance, it is expected that the television drama shown on Channel A and Channel B on Thursday night can be viewed 2.000.000 people and the total price of a time slot on Channel A is fixed as $100.000 and $150.000 for the program shown on Channel B. It is assumed that the total GRP that is obtained from the each program is 25. The value of gross impession is generated as 50.000.000. This means that the advertising will totally get 50.000.000 impression. When the

formulation is CPM is considered, since the total cost is $250.000, CPM of the this schedule is estimated as $5. This is the cost of the reach to 1,000 within the identified time schedule. As the different combinations of program or time schedule can be selected and estimated with the similar fashion, advertisers can compare the price and make a better decision. In this point, to explain how the purchasing of the time slots within the programs is conducted will be useful.

First of all, generally television time is priced based on a 30- second spot and in case of the advertisers desire to buy more or less , the price is adjusted accordingly, the negotiation process is approached upon the value of CPM (Katz, 2003). On the table 2.4. the advertising tariff which is applied one of the Turkish TV channels, TV8, is displayed. As it can easily be observed, there are two remarkable points which are worth to speak.

Tablo 2.4. The Advertising Tariff Applied by One of The Turkish Tv Channels

Time Slot	The Code Of Time Slot	Price (TL/sec)	Price (TL/ 30 sec)
Prime Time		1000	30000
13.Category	C-13	850	25500
12.Category	C-12	750	22500
11.Category	C-11	600	18000
10.Category	C-10	525	15750
9. Category	C-9	450	13500
8. Category	C-8	400	12000
7. Category	C-7	375	11250
6. Category	C-6	275	8250
5. Category	C-5	230	6900
4. Category	C-4	150	4500
3. Category	C-3	75	2250
2. Category	C-2	50	1500
1. Category	C-1	35	1050

One of them is, the day time is divided into different categories acccording to their capability of attracting viewers. These pattern vary channel to channel . For instance, while TV8 prefer to distinguish its viewing time into 14 different categories, CNN TURK applies a price list which consists of five different category such as *golden, prime time, prime time special, off prime time, off prime time special* (Hızal, 2013). As long as the program in a specific cagetory reaches higher viewing level, the value of category, in other words, the price of per second rises by directly proportional.

Another important point when the unit prices per second are compared, it is clear that most valuable time slot is *prime time. Prime time* denotes the time interval between 19:00-23:59 when the viewership levels reach highest point. Napoli (2003), stated that generally, television viewership gradually increases throughout the morning, levels off at approximately 30 percent of households during the early and mid afternoon, and then increases rapidly in the late afternoon after peaking at about 10 p.m. within prime time interval -when almost 70 percent of television households are likely to be watching- viewership levels begin to decline sharply (Napoli, 2003). The latest research conducted by RTUK (2013) pointed out, in 2012, when the television viewing times in weekdays are examined, % 53.7 of people is preferred to watch television between "18.01-21.00", % 61 of them prefer the time interval "21.01-24.00" and the time slot "15.01-18.00" is chosen by %18.7, of total viewers, futhermore, when the figures for weekend are reviewed, since % 57.1 of viewers spend their time in front of the television between"18.01-21.00", % 70.2 of them prefer the time interval "21.01-24.00" it can be said that, likewise on the weekdays, prime time is the most preferred time period for television viewing by the audiences at weekends as well.

At this point it would be appropriate to discuss about the situation of television viewing habits in Turkey. According to latest research conducted by Marketing Turkey (2014), Turkish viewers spent avarage 4,42 hrs/day by watching TV in 2011 and this time has increased to 4,57 hrs/day in 2012 and climbed up to 4,81 hrs/day in 2013. It is clearly seen that, the time allocated for television viewing habit has increased over the years. Another conspicious result is that the

television is viewed much more time in the winter than it is viewed in the summer (Table 2.5). It is seen that the seasonility is a remarkable success factor that can effect the success of a television product. In the application section of our study, this factor will be briefly explained.

Table 2.5. Avrg. TV Viewing Time in Turkey (Mn/Day) (Marketing Turkey,'14)

	2011	2012	2013
January	277	319	326
February	280	316	324
March	272	299	312
April	260	267	290
May	279	261	270
June	260	236	261
July	206	222	257
August	246	227	240
September	241	255	270
October	270	269	283
November	288	305	306
December	304	317	326

When the daily television viewing time is compared in terms demographic variables suxh as the age, sex and the employment status, it is observed that the women spend more times in fronf of the television than the men do. The similar fashion comparision can be viewed between the unemployed people and the employees (Figure 2.7)

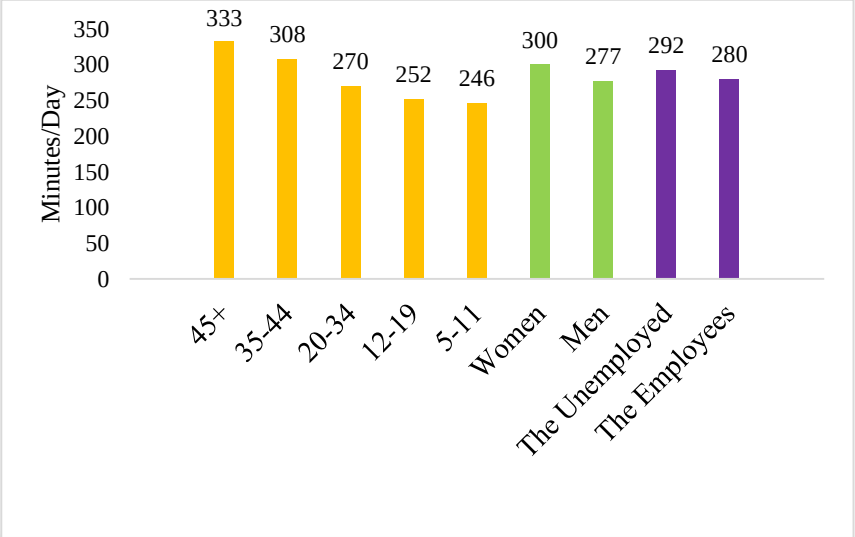


Figure 2.7. Daily Television Viewing Time (Avg.) (Marketing Turkey, 2014)

It is essential to say that all these data is compiled from the database of audience measurement system. After the frequently used terms and the prurchasing procedure of time slots are introduced, a short and brief explanation about the audience measurement system would be beneficial.

Audience measurement being made since 1992 in Turkey has great importance for television broadcaster,advertising and media planning agencies as mentioned before. According to obtained results the producers and the program planners arrange and if necessary reschedule the programs by tailoring the needs and the preferences of the audiences. Thus, they object to maximize the number of the audiences to be able to get more share from the advertising pie. Advertisers can see which product is value to invest to reach more customer. The results of the measurements play role in the decision making process of the selection of television channel and television product for the advertisers. There is no doubt that as long as the number of the audience increases, the value of the product increases in the advertisers' point of view. Since these measuerements includes detailed information in terms of the socio-economic status, age, destination of the audiences and some other techniqual details such as time allocated for TV, most

preferred program, which segment prefers what sort of programs, the system allows to make comparision regarding the performance among the TV channels or contents and function as a guide for the media planners (Güler, 2011). According to Ang (1991), there is only one goal of all efforts for audience measurement is that : to be able to take the carefully packaged audiences to the advertisers (as cited in Günalp, 2007).

Since the first time, the need for measure of the audience has occured, several tehcniques have been applied up to date. The rapidly changing environment of the techological developments effected the nature of the media usage and the measuerement techniques of the audiences as well. When the first attempts for audience measuremet are examined, some techniques which are basic but providing insufficient data have been applied. The telephone call, the diary and the questionnaire techniques are the first efforts for the audience measurement. Before discussing in detail, it would be beneficial to explain the issue of sampling that is applied for all the measurement techniques.

Logistically, it is impossible to interview or to obtain data from every single member of the population, therefore there is a need to estimate the audience from a subset that is called a *sample* (Bornman, 2009). The quality of the sample has a significant influence of the accuracy of the measurement results. Although research organisations mostly prefer to study on samples whose member are selected by probabilistic manner which they have the same chance to be selected, the sample might fail to represent the whole population accurately. It is necessary to consider the potential of inability to represent whole population in the process of sampling. Today, this issue is still discussed and critised.

When we return the starting point, each of the pre-mentioned techniques had some limitations and advantages. Telephone calls/coincidentals were being carried on by choosing a number from the phone book and the household was being called and asked what is watched or seen at that moment (Güler, 2011). This technique was providing the data instantly but it was open up the errors as

well. Since the households to be talked were being selected from the phone book, there were some concerns about the representation capacity and the quality of the all population of the selected technique. Secondly, there were practical limitations on where and when calls can be made (Bornman, 2009).(The programs that are viewed at night time were not being identified). In social survey technique, the vievers were forced to remember what they watch accurately which is not possible in terms of precision of the details and the contunity of the provided data. The diary technique was cheap and allowing to reach more people and from this point of view, the sampling could be expanded but this method can only be applied on litarate viewers (AGB Nielsen Media Research as cited in Günalp, 2007)) and the viewers could manipulate the results by stating their favourite program instead of what is really watched. To deal with the mentioned shortcomings of the applied techniques, metering devices have been invented and introduced to the industry.

Peoplemeters which are developed in the early 1980s by London-based research group "AGB Research" are currently the only electronic device that measures exactly who is viewing a particular set in a household (Bornman, 2009). In this system, a device –peoplemeter-consisting of three different units: frequency detector, record unit and remote control (Özbek et al, 2011). When a particular member of the household starts viewing, he or she is supposed to press the pre-assigned button on the remote control and to press the button again when he/she leaves the room (Bornman, 2009). The data come from the frequency detector and the remote control, is gathered and saved by record unit and the whole records are sent via telephone line end of the day (Özbek, 2011). In Turkey, the first of television audience measurement is done AGB Anadolu in 1989 (RTUK, 2014) (In 2005, AGB Group and Nielsen established an partnership and the institution maintained its researches with the name of AGB Nielsen Media Researh all over the world). In 1992, the TV Audience Measuerement-Joint Industry Committee (TIAK) has been founded within the International Advertising Agency (IAA) with the purpose of organizing and the auditing the television audience measurements (Güler, 2011). Until 28 December 2010, TIAK

has functioned with a committee consisting of 15 people including three members of Advertisers Association, Association of Advertising Agencies, International Advertising Agency and the representatives from television channels (RTUK, 2014). Due to the ongoing discussion over the years and the emergence of the irregularities and manipulations in audience meauserement in 2009 (RTUK, 2014) TIAK launched a bidding for the audience metering in 2010, and the audience measurement activites were devolved to TNS Piar from AGB Nielsen Media Research (Sözeri & Güney, 2011) (Güler, 2011). Though, this progress, TRT (Turkish Radio Television Institution) channel sustained to claim that the structure of the TIAK does not carry the legal standarts and broke off the TIAK and started to work with SBT (Sözeri & Güney, 2011)(RTUK, 2014). In 2013, TRT has involved to TIAK again and continued to work with both metering companys, TNS Piar and SBT. After a while, SBT started to serve to other televsion channels. In 2013, TRT has joined new rayting system that is conducted by TNS. To sum up, today, the television audience measuerements are officially conducted by the peoplemeter technology with the organization and application of TNS and the inspection of TIAK in Turkey. SBT also provide the data to the industry. The sample identified by TNS has been generated from 40 provinces and the provincal centers where the population is over 20,000 and 2924 households in these regions (RTUK, 2014). The SBT creates the sample from 15 province and takes into account places where the population is over 1000 and 2684 households in these regions (RTUK, 2014). The main difference between two system is that in the sampling process, SBT implicates more rural areas than TNS does and SBT can provide the results instantly. Daily results are revieved and reported to the Advertisers Association, Association of Advertising Agencies, International Advertising Agency and the television channels.

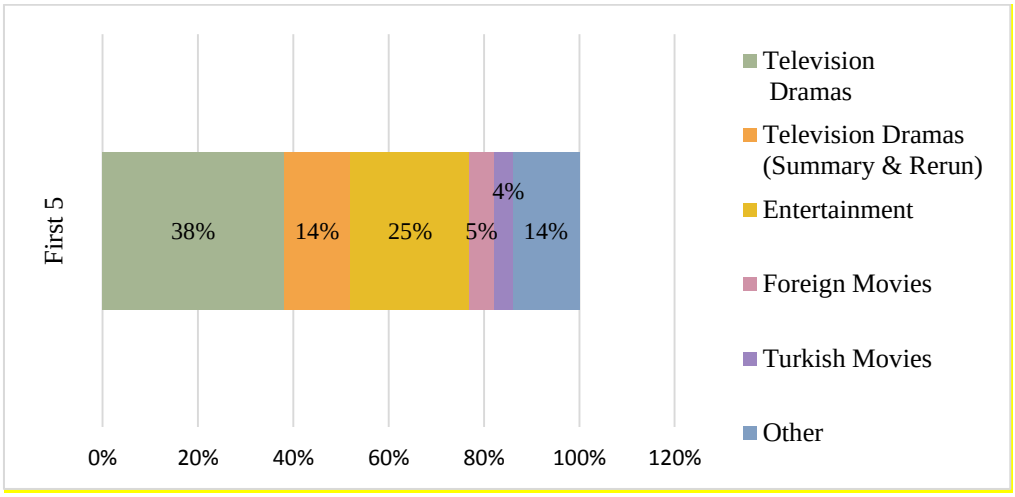


Figure 2.8. The Most Viewed Program Types of Most Popular 6 Television Channel in Turkey (2013-2014 Season)(compiled from TNS, Deloitte,2014))

As it is identified before, within the paralel of the success in the viewing levels, the advertising revenues of the television channels increase. In the figure 2.8 the top six television channels that achieve the highest rating levels can be observed and it can easily be television dramas have a significant place in the television viewing. Since this viewing tendency promise to the advertisers and the advertising agencies high level of audiences or customers, television dramas become more valuable among other type of products. In next section, the place of the television dramas in Turkey televisions and the process they have undergone within the last two decades will be explained in detail.

3. TELEVISION DRAMAS

The program types and formats, usually created by the practice of the viewers and the listeners (Yaylagül, 2013). All the formats and types basically aim to meet the requirements –which are mentioned in first section of our study- of the audiences. Though the television channels make an effort to produce the contents that are able to meet various requiremets of the audiences', it is a fact that television dramas have a special place in the audiences' heart.

In Turkey, the first attempts of television drama broadcasting are based on the imported productions such as "Dallas". The subsequent years domestic productions are started to aired. In this context, the first domestic television drama -which is a sort of situation comedy (sit-com)- is "Kaynanalar" and "Aşk-ı Memnu" -which is shot in 2008 one more time - is produced for TRT in 1975 (Tanrıöver, 2011). Since the middle of 1990s, for 20 years, the number of domestic television dramas show steady increase. This situation reflects the audiences' viewing behavior and the choices of the channel owners as well. The latest studies indicate that, in 2013, television broadcasters allocated average 1342 hours/year for news, 1024 hours/year for actual programs, 1093 hours/year for cultural programs, 606 hours/year for educational programs 93.6 hours/year factual programs, 1062 hours/year for entertainment programs, 571 hours/year for children programs and the 1333 hours/year for television dramas. (RTUK, 2014). It can be inferred from the figures that the television dramas have the widest time period after the news. There is no doubt, as it was expressed in the introduction of this section – the practice and the viewership behavior of the audiences identify the role and the place of the television dramas within the distribution of the all types of programs.

When the reasearch carried out by RTUK is examined , the question of why the television dramas are given so much time is clearly answered (Figure 3.1).

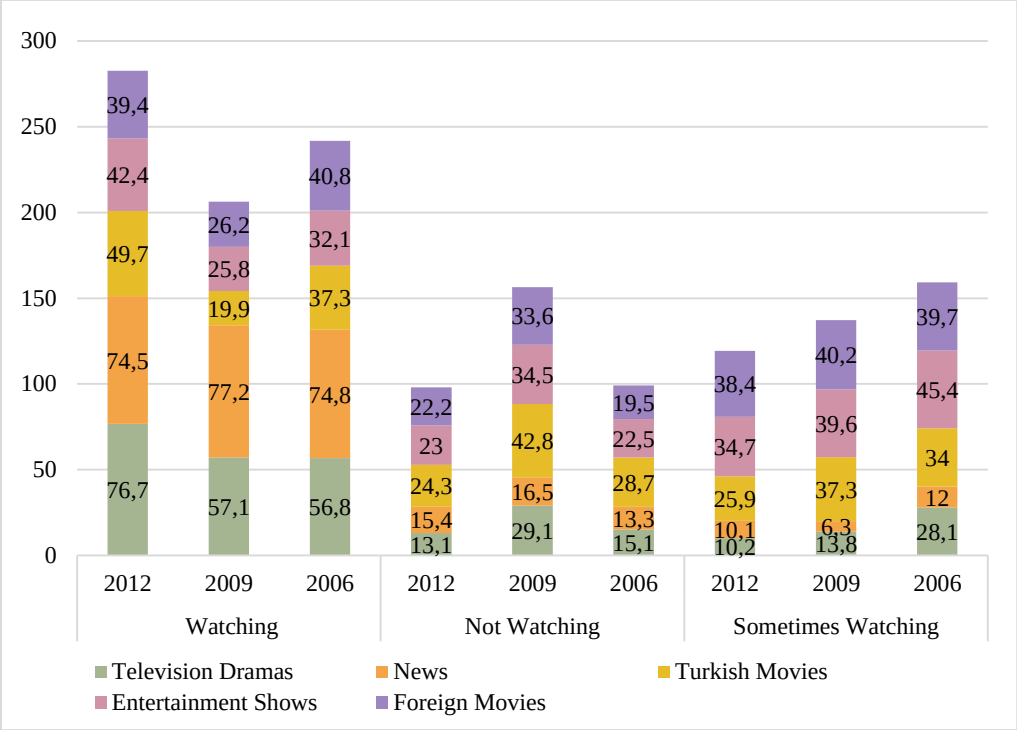


Figure 3.1. The Television Viewership Habit by The Type of Programs in Turkey (Deloitte, 2014)

Figure 3.1 shows that there is a dramatic and regular increase in the number of the people who watch the television dramas. While the 56.8% of the Turkish people watch the television dramas in 2006, this ratio achieve to 76.7% in 2012. Another questionaire research conducted by RTUK, demonstrates that the television dramas are the most desirable contents to be brodcasted with 86,3% when the audiences'preferences are taken into account (Figure 3.2)

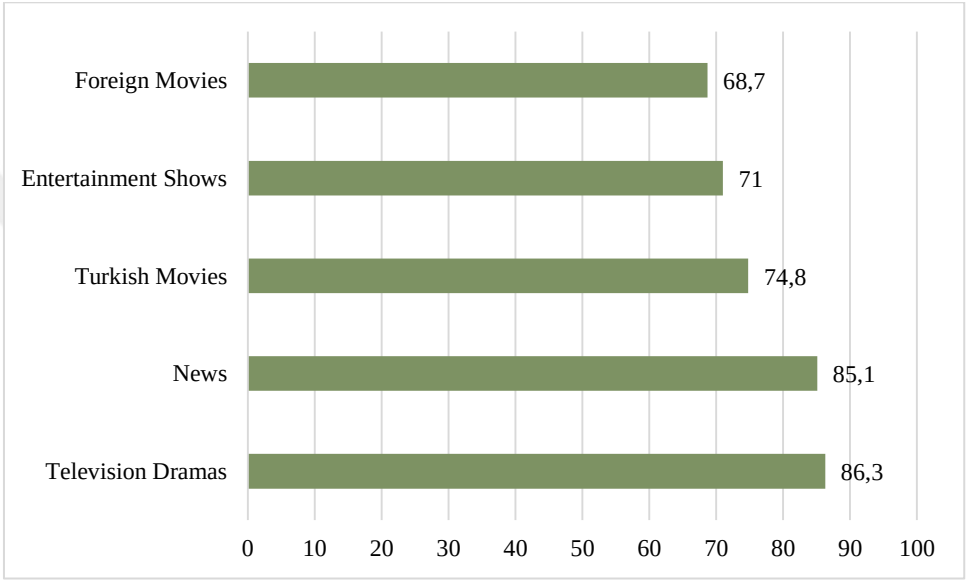


Figure 3.2. The Desired Programs to be Broadcasted on Television According to Priority (RTUK,2012)

From this point of view, the relationship between the choices of television broadcasters and the audeinces, it is obviously seen that a sort of paradoxal state occurs. The desires and wants of the audiences has undoubtly great influence on the decision making process of the broadcasting side. When the fact that the advertisers aim to reach more people is considered, television dramas are the best fit contents that work for the benefits of the all sides. More dramas leads more people who prefer to watch them (Figure 3.1). More people who watch the television dramas lead the more dramas shown on the television. In Figure (3.3).

the distribution of the program types on the televsion within the prime time interval can be seen.

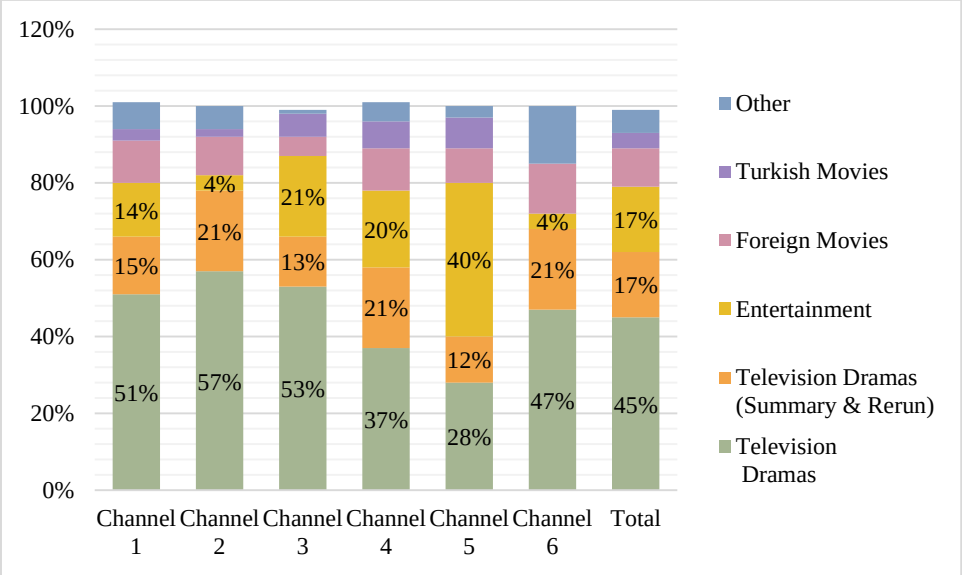


Figure 3.3. The Distribution of the Program Types in the PrimeTime Interval (2013-2014 season , Deloitte,2014)

One another stunning result is that , the summaries of the previous episodes or the rerun of them have a significant rayting success even they have been shown and reached to the audiences before. This situation suits to advertisers and and the television broadcasters due to good reflection of the advertising revenues to the financial charts.

It is necesssary to say that as big amount of money is obtained from the television dramas, they are produced with a considerable cost as well. When it comes to financial aspects of the television dramas, it would be beneficial to give some information about the production companies and general production process.

The costs of a televsision drama can vary according to type of the dramas (e.g. the sit-coms are produced with the less costs), competition, scenario and the ability of negotiation of the production companies. Hovewer, especially in the last decade, with the substantial ascension in the television dramas and the

occuring severe competitive environment, led the producers to create better quality products and this orientation inevitably led an increase in the cost. To be able to achieve high rating levels and the benefit from the sponsorships, working with the celebrities is a key success factor. Naturally, more fame means more money to be invested. According to research done by Deloitte (2014), the amount paying for the actor/actress constitutes the largest cost item in the budget. When the star value of them increases, the ratio reaches to 45% of the total cost is allocated for the players' budget. Acting costs are followed by the operational costs and the decor/setting costs. Additionally, a considerable amount of money is invested for the directors and scriptwriters. Yağcı (2011) pointed out that approximately 150 directors and 300 scripwriters worked for the industry in 2010. While 10-20 people serve in front of the camera, a huge team consists of 60-100 people attend to the production process of a television drama (Sönmez, 2008 as cited in Yağcı, 2011). While the number of the cast agency can be expressed with 5-6, the latest research done by ISMMMO demonstrates that the number of the cast agencies have been reached to hundreds and the number of the enrolled players to the cast agencies is estimated 50 thousands (ISMMMO, 2010). Generally speaking, considering the global economic crisis, it is known that the television drama industry provides employment to the 100 thousands people (ISMMMO, 2010).

Production companies sell their products to the television channels by adding %20-%40 of the total cost (Sözeri & Güney, 2011). In Turkey, the main financial source of the production companies is the fee per episode paid by the television channels. When the drama get success, it can be exported to the other countries and production companies can acquire a noteworthy revenue from the selling operation to the foreign countries as well. Up to date, it is known that the Turkish dramas have been sold to approximately 75 countries and viewed by 400 million people (Deloitte,2014). According to the views of the experts in the industry, while the fee per episode paid by the television channels can vary between 200.000-700.000 US dollars, this amount can vary 500-200.000 US dollars when the drama export to the other countries (Deloitte, 2014). It could be possible to

sell a Turkish drama to the other country 400-500 US dollars per episode ten or fifteen years ago but especially in recent years, with the incrase in the technical and artistic quality of Turkish dramas, the number of the exported dramas and the obtained revenues has also dramatically incrased. In Turkey, 80% of export of the television drama is conducted by Calinos Entertainment and the first television drama sold to Kazakhstan by Calinos is " Deli Yürek" in 2001 (ISMMMO,2010). One another drama , "Gümür (Noor)" is sold to the broadcasters in Mısır, Middle East and Gulf Countries via the external links of the Channel D (Tanrıöver, 2011). The final episode of "Gümüş (Noor)" has been viewed by 84 million people in Middle East Countries (Karakaya, 2013). Recently, historical dramas became trendy, a new television drama phenomenon arose in Turkey: "Muhteşem Yüzyıl (Magnificient Century)" . Muhteşem Yüzyıl (Magnificient Century), the controversial drama series on Ottoman Sultan Süleyman the Magnificient , now airs in 70 countries and has been exported to Italy, the first Western European country to purchase the series (Çevik, 2014). Over the years, the increase in the quality of the dramas has reflected the production cost and the revenues obtained has steadily increased as well. According to the research of the Forbes Turkey, the first ten production companies including Ay Yapım, Tim's Production, Avşar Film, MinT Production, D Production, Pana Film, Gold Film, Focus Film, Erler Film and TMC Film has achieved 450 million TL total revenue (anticipated) and 45 million TL profit (anticipated) (Deloitte, 2014). When it comes to the export revenues, the Figure 3.4 clearly demonstrates the trend of incrase in the revenues of the export operations of the Turkish television dramas within over five years.

If the whole picture is examined, the exports of the television dramas not only contribute to the Turkish ecomony with the revenues obtained from exportation but also they contribute to familiarize the Turkish culture and Turkey. By this recognition, Turkey became a intriguing a country for the people who live in the countries where the dramas are exported to. Thus, the tourism revenues are effected in a positive way, so this process has indirectly benefited to the Turkish economy as well. According to research of Skyscanner, there is a strong

correlation between the dramas aired and flight searches, so that, when the flight searches are compared 2011,2012 and 2013 ,the number of people searching Turkey has doubled ; where the Turkish dramas intensively shown Kuwait, Quatar, Yemen, Lebanon, the flight searches increased more than 100%, in Bahrain and Saudi Arabia this ratio has incrased more than 200% (Deloitte, 2014). Furthermore, the home textile, furniture, accessories, costumes, cars, food situated in the content incrase the recognition and demand of these product groups in abroad and domestic market therefore contributed to the national economy. Along with all these developments, in 2010, Turkish Foreign Trade Ministry declared that the cinema and drama industry is the 24th industry which is supported in the scope of Turkey's export and the efforts are started to arrange some regulations that allow this sectors to benefit from the incentives applied to the other industries (Tanrıöver, 2011). According to data obtained from Culture and Turism Ministry, as of the year 2011, 10500 hours of television drama has been exported to the countries in Middle East, Africa, Balkans and the gained revenue has exceeded 60 million dollars (Karakaya, 2013). Even real estate industry benefited from the blessings of the television drama industry, so that ,from mansion to museums, offices, palaces, historical buildings are rented with the special price tariffs to the production companies (Sönmez,2010 as cited in Yağcı,2011).

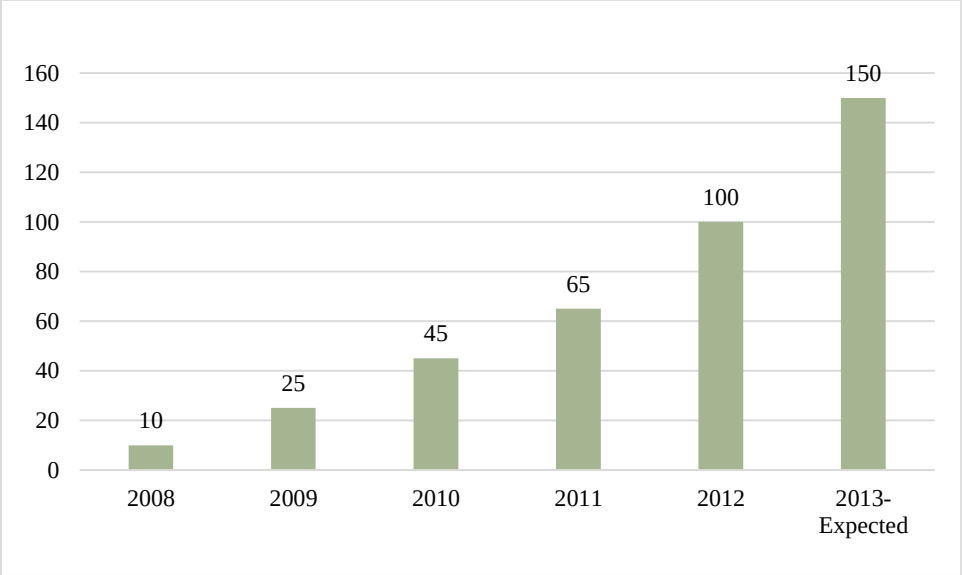


Figure 3.4. Export Revenues of the Television Dramas (Calinos Holding, Hürriyet, Dünya.com compiled by Deloitte,2014)

As a natural result of such a industry that can allow to gain huge amount of money to the investors, every year the number of the television dramas started to broadcasted have been drastically increased. The research conducted by Deloitte (2014), points out that each year, average 50-70 television dramas are released but more than half of them is removed after a couple of episodes are shown on the television due to the severe competition. The figure 2.5 presents some remarkable facts about the television drama consumption in Turkey from 2010 to 2014. In Figure 3.5, the television dramas are categorized according to their starting seasons and the seasons they are removed from the screen. In 2010/2011 season, 29 of the first released television dramas have been removed in the same season. In 2011/2012, the number of the removed television dramas have reached to 35, though there is a small decraese in the 212/2013 season to 30, this figure has ascended to 41 in 2013/2014 season one more time. As it can be observed on the figure, all these removed dramas have been started to shown in the same season. It is clearly referred from these results, the toleration for the dramas which reach low rating levels have decreased over the years.

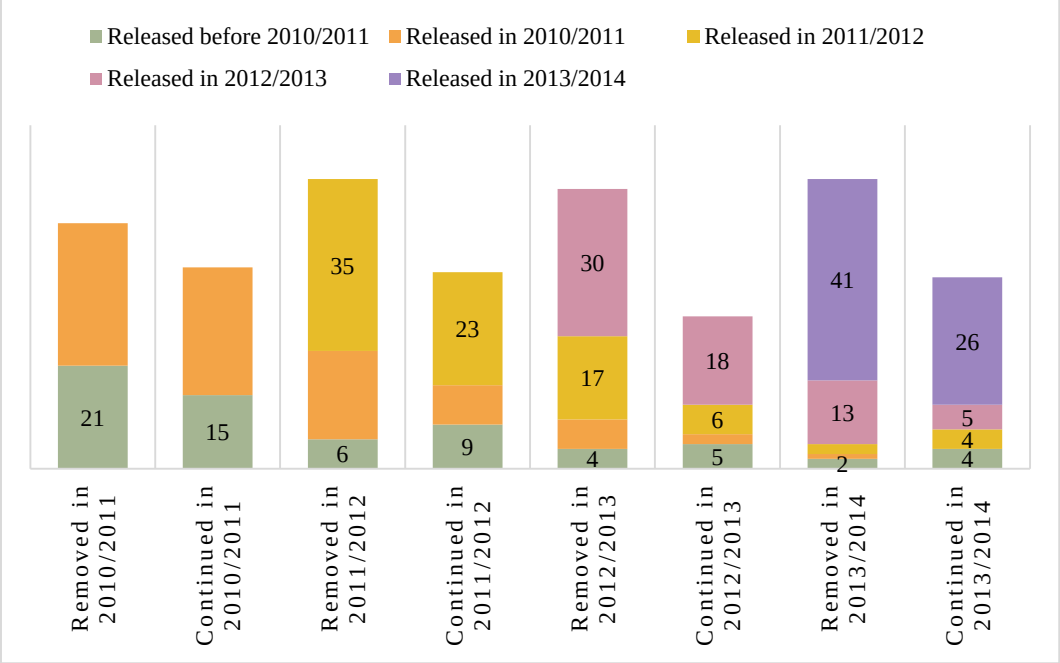


Figure 3.5 :Television Drama Consumption in Turkey (unit) (Deloitte, 2014)

Another study that reveals how vicious competitive environment existed in the field and how the television channels developed more impatience and intolerant attitude to the unsuccesful –in terms of rating levels – television dramas over the years. As the dramas can be terminated at the end of the season, most of them are terminated after just a couple of episodes are shown. Figure 3.6. displays the distribution of the television dramas according to the number of episodes that shown until the their terminations. When the figure is examined in detail, the most outstanding outcome of the study, the dramas are mostly removed between the seventh and twelfth episode. Another result is that , as it is discussed before, the tolerant behaviour have decreased through the years. While the number of the dramas that are removed between the first and sixth episode was 5 in 2010/2011 season, this value has increased to the 13 in 2013/2014 on the other hand, the number of the dramas that are removed their 24th or following episodes have decreased regularly over the years.

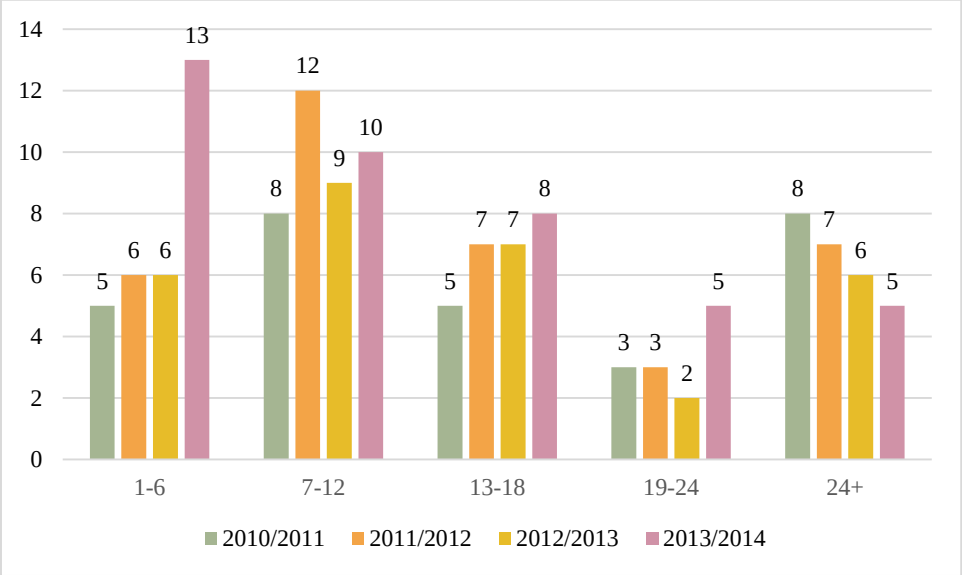


Figure 3.6. Number of the Television Dramas According to Number of the Episodes Removed (Deloitte, 2014)

To express the seriousness of the state, the following Figure 3.7 is simply summarize the struggle of survive of the televislon dramas.

As of June 30, 2014, 26 of 39 broadcasted dramas (67%) in their first season, 5 of them (13%) is in the second season, 4 of them (10%) is in the third season, the remaining 4 (10%) is broadcasted more than three seasons (Deloitte, 2014).

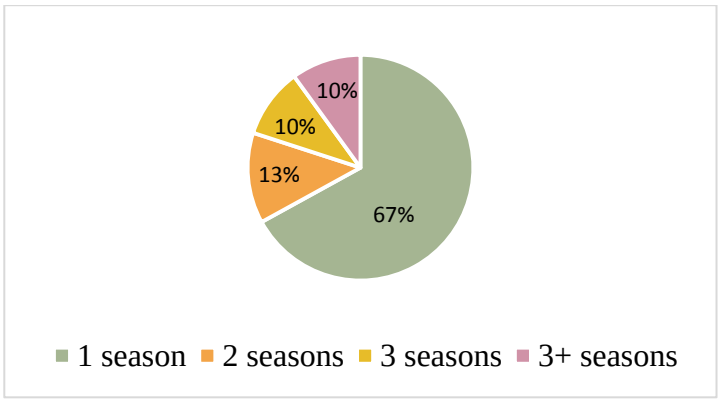


Figure 3.7. The Contunity of the Television Dramas (Deloitte, 2014)

When we go back to economic aspect of the television industry, it would be useful to remind the advertising gaps are generally purchased in advance before the release of the product-television drama in our case- and naturally the stakeholders like media agenices, advertisers, advertising agencies, television broadcasters, especially, who invest the money in the product; need some methods to be able to predict future ratings. To deal with this issue, several studies have been conducted so far. Before explaining the proposed method, a literature review will be presented.

4. PREVIOUS RATING FORECASTING STUDIES

Although, the issue of the rating forecasting is one of the most difficult tasks, the literature suggests a limited work since the 1980 when the topic first drew attention of the scholars. The first studies were based on getting the optimal scehedules for television programs. While the algorithms were developing, some variables that can affect the rating level had been taken into account.

Gensch&Shaman (1980) and Henry& Rinne (1984) constructed models that are accurate for predicting ratings of shows that are placed in new time slots, though they do not optimize television schedules (Danaher & Mawhinney, 2001). Gensch& Shaman (1980) predict the rating with the trigonometric regression model while Henry &Rinne (1984) use multinominal logit model. Horen (1980) proposed a model based on the integer programming to be able to get optimal television program sechedule. Rust and Alpert's (1984) audience flow model provided a way to make some variables such as audience flow effects, program type, and viewer demographics quantifiable and useful for prediction of individual viewing choice. Rust and Eechambadi (1989) devised a new heuristic model for the scheduling of network and estimated average audience share. Tavakoli & Cave (1996) proposed an dynamic logit model of viewing behaviour which effects the channel ratings and audience composition by taking into account the programme type, channel, audience appreciation effects. Kelton and Schneider- Stone (1998) developed a regression model in which show-part ratings are regressed on variables such as day, time slot, show attribute and competitive effects that influence television viewership and applied the model to obtain optimal television schedule. Reddy et al (1998) proposed a further generalization of Horen's research by combining mixed-integer, gneralized network-based flow, mathematical programming model to get optimal schedule

that takes into account the actual cost of each show to a network. Danaher & Mawhinney (2001) used logit model to derive the optimal schedule for the New Zealand network. Napoli (2001) applied regression analysis to identify the possible determinants of forecasting error for new prime-time network television programs. Weber (2002) benefited from the techniques that could be considered modern forecasting techniques like neural network for rating prediction. Patelis et al (2003) developed a decision support system including regression and grid search algorithms for forecasting viewership. Patelis et al. (2003) recommended that rating forecast models need to be supported by a Decision Support System which incorporates qualitative factors for the forecasting of television viewership and allow easy access to information and "what if" queries as well as the entry of exceptional influence impacts on television viewing(as cited in Meyer & Hyndman, 2005). Meyer & Hyndman (2005) compared the accuracy of three model estimation tools (regression, neural networks and decision trees) and concluded neural network perform best since they allow for interaction effects and for any non-linear rating carry-over effects from one period to the next. Yilei (2009) combined data envelopment principle with the classical GM model to predict the ratings of new television programs. Danaher et al (2011) review previous TV rating forecasting methods from naïve empirical forecast model to state-of-the-art Bayesian model which performs better predictions than previous methods and they concluded that the forecasting methods that have been used in the past are not generally very reliable, and many have not been validated; also, even more distressingly, none have been tested in today's multichannel environment. Danaher & Dagger (2012) developed a new forecasting model which is suitable for aggregate TV ratings based on nested logit model. Huang et al (2013) proposed an evolutionary approach to designing a rating model (ERM) by simultaneous optimization of sampling sub-area selection and parameter tuning using an intelligent genetic algorithm (IGA) and used 140 million data records collected from Taiwan digital CATV digital system.

Cheng et al (2013) developed a rating forecast module based on Back Propagation Network and they used the number of comments, posts, likes and shares as the data in their study but they did not applied their module to predict the ratings of the first episode.

After the review the previous studies on rating forecasting, it is necessary to mention comments and thoughts about the efficiency and the usability of these techniques. According to Yilei (2009) since the broadcasting time of new TV programs is short and the data accumulation is insufficient, the audience rating of these new programs displays such features as few data, few information and uncertainty so the traditional statistical and quantitative methods can not be used to conduct modeling research on audience rating, and the prediction precision is also difficult to meet the demand. Most of the models have been developed to predict only short-term ratings like 15-30 minutes and most of them were not included demograhic variables which can significantly effect rating forecasting. The interaction of the variables among each other has ignored; except Swann&Tavakoli (1994) - in their study they allowed interaction between the genre and the demographics (gender, age etc.) and Kelton&Stone (1998) allowed the interaction between genre and the time of the day and day of the week.
Weber (2002) also emphasizes that the necessity of nonlinear explanatory models which contain various determinants of TV usage in order to calculate forecasts.

Considering the current situation and reviewing the literature, it is thought that the FCM might be a good starting point to get better understanding about the determinants of the audiences' drama viewing and interactions between them. As it can be seen in the literature review of the FCM, as far as we know, this is the first attempt for the prediction the success of the television dramas. Before the application procedure, it would be beneficial to give detailed information on FCM.

5. OVERVIEW OF FUZZY COGNITIVE MAP (FCM)

Although Cognitive Maps (CMs) developed by Axelrod (1976) are easy to use, they have trouble while quantifying casual relationships among variables. CMs lack the capability to differentiate the strength of relationships, it just express the relation positively or negatively. Also, every node just makes its decision according to the number of positive impacts and the number of negative impacts; thus, a CM is an oversimplified model for many applications. If one were to emphasize that the simple binary relationship of a CM needed to be extended to include various degrees of increase or decrease (small decrease, large increase, almost no increase, etc.), then an FCM would be more appropriate.

Fuzzy Cognitive Maps is a modeling methodology for complex decision systems, which originated from the combination of fuzzy logic developed by Zadeh (1965) , and neural networks (Glykas, 2012). Since the first time FCM was introduced as an extension of CMs by Kosko (1986), it has been applied as an effective decision making tool in many areas. FCM, represents a system in a form that corresponds closely to the way human perceives it (Rodriguez-Repiso et al 2007).

Özesmi&Özesmi (2004), Yaman &Polat (2009), Stach et al (2005) and Jetter & Kok (2014) compiled the advantages that make FCM one of the most preferrred decision making tool as follows:

- It is easy to built and intiutive to understand and gives qualitative results.
- The strength, signs and relationships between the concepts can be changed and simulated easily.

- It is also characterized by flexibility of system design and control, comprehensible structure and operation, and adaptability to a given domain.
- It shows an abstract represantation and are capable of fuzzy reasoning.
- In contrast to cognitive mapping, FCMs furthermore allow a quantitative analysis of the quasi-dynamic behaviour encoded in the FCM models to aid decision making.

Generally speaking, FCM describes the behavior of the system in terms of concepts; each concept represents an entity, a state, a variable, or a characteristic of the system (Dickerson&Kosko, 1997). The structure of FCM is substantially based on nodes and weigthed arcs. Nodes of the graph represents concepts that can be correspond an entity, a state or a characteristic that effect the behavior of the system. Directed, signed and weighted arcs, which represent the causal relationships that exist between the concepts, interconnect the FCM concepts (Georgopoulos et al, 2003). The graphical illustration of FCM is given in figure 3.2.

FCM has been widely used in modeling and preparing decision support systems tool in different scientific and managerial areas such as earth and environmental sciences, engineering, economics, business ,medicine. In the next section , the application areas of FCM and a comprehensive literature review will be presented.

5.1.Literature Review

FCM has been applied sucessfully in several areas from medicine to astronomy for decision making and the prediction since the first time it was proposed by Kosko (1986). Bowles & Pelaez (1996) applied FCM for Failure Modes and Effects Analysis (FMEA) to predict the failure effects in a complex system. Kalamaras (1997) developed a computer based system by using FCM to predict the excavability conditions for tunnel- excavation. Banini&Bearman (1998) used FCM to study the factors affecting the rheological behaviours of suspension slurries in the mineral industry. Scheider et al (1998) developed a automatic construction system for FCM that aims to find the degree of similarity between any two variables and the relation between variables is direct or inverse and applied their method to identify the factors that effect the population growth. Marchant (1999) clearly defined the cognitive maps on the concept of fuzzy implication. Karakostas & Kardaras (1999) suggested an application of FCM to simulate the process of strategic information system planning to assist planners to identify specific and strategic IT projects. Groumpos &Stylios (1999) implemented FCM in the modelling of the supervisor of a control system that is operated on the order of qualitative information and knowledge.

In 2000s , interest of scholars to the FCM rapidly increased. When the numbers of publications are compared with the period from 1980 to 2000, this increase is obviously seen. Lee (2000) proposed to use FCM for the design of electronic data interchange controls and used FCM to evaluate performance of electronic data interchange system (Lee, 2004). Miao et al (2002) proposed an approach to design of intelligent agent based on the theory of FCM. Lee et al (2002) proposed a new web-mining inference amplification mechanism using the inference of FCM. Skov & Svenning (2003) developed and approach based on GIS which is constructed by FCM to predict species richness in a managed forest. Georgopoulos (2003) approached FCM to differential diagnosis of sepecific language impairment which is a sort of language disorder and tested his model four clinical cases. Innocent & John (2004) developed a computer aided fuzzy

medical diagnosis system by using FCM. Kang et al (2004) applied FCM for the relationship management in airline service. Muata & Bryson (2004) studied on generating consistent subjective estimates of the magnitudes of casual relationships in FCMs. Xirogiannis et al (2004) developed an application to use urban design. Özesmi & Özesmi (2004) developed a multi- step FCM approach to examine the views of different stakeholders in an environmental conflict such as governmental, nongovernmental organizations and local people. Groumpos& Papageorgiou (2005) developed a new hybrid method to train FMCs, involves nonlinear Hebbian learning algorithm and the differential evolution algorithm, to promote the effectiveness of the learning process of FCM. Stach et al (2005) introduced genetic learning model for FCM that allows to generate FCM models from historical data without human intervention. Similarly, Kim et al (2008) suggested FCM model learning by genetic algorithm is used for forward and backward anaysis RFID (Radio Frequency Identification) technology in the field of supply chain. Chakrabotary& Konar (2005) developed a new reasoning and unsupervised learning approach for FCM. Giordano (2005) used FCM for identification of the issues in the water resources management that can be basis of resolution system. Yu & Tzeng (2006) developed fuzzy decision making method based on FCM technique to handle with the structural problems of multi-criteria decision making technique. Cruz & Pajares (2006) proposed FCM model for stereovision matching. Luo&Zhuge (2006) proposed an approach that generates document semantics based on FCM. Papageorgiou et al (2006) presented and compared two different unsupervised training technigue for FCM and applied the model on industrial process control to define how much they are effective for fine tuning of the weights of casual interconnections among concepts. Kurgan et al (2007) performed FCM that quantify the strength of relation between the hydrophobicity scales/indices and the protein content values for novel scales based on hydrophobicity indices for protein structure. Karlis et al (2007) applied FCM in electrical and computer engineering by appliying FCM to get the maximum power of any photovoltaic power system array under different conditions such as temperature, insolation etc. Xirogiannis & Glykas (2007) developed intelligent model of e-business maturity by applying FCM. Miao et al

(2007) proposed a new type of personalized recommendation agents called fuzzy cognitive agents that represent knowledge via extended FCM to give personalized suggestions based on the user's current personal preferences and expert's domain knowledge. Lee& Lee (2007) constructed a causal knowledge-based expert system based on FCM methodology for modeling and designing electronic data interchange controls. Alizadeh et al (2007) compared the effectiveness of simulated annealing and genetic algorithm learning models in FCM. Stylios et al (2007) developed three different types of FCM architectures (competitive, distributed and hierarchical) for medical decision support systems. Giles et al (2007) used FCM to integrate conventional science and aboriginal perspectives on diabetes in Canada. Bertolini (2007) presented an FCM approach in order to discover the human reliability factors in industrial plants. Lee & Kwon (2008) a FCM based expert system that supports decision making process in business to business negotiations on the Internet. Wei et al (2008) used FCM for identifying , modelling and evaluating trust dynamics in the virtual enterprises. Papageorgiou et al (2008) implemented FCM technique which is supported by hebbian algorithm for the brain tumor characterization. Xirogiannis et al (2008) proposed a methodology tool utilizes the fuzzy FCM to generate a hierarchical and dynamic network of interconnected HR performance drivers. Espinosa-Paredes et al (2008) presented a FCM approach for emergency management for a nuclear power plant and similarly Paredes at al (2009) made an risk assesment by modelling risk scenarios for nuclear power plants in a boiling water reactor and analyzed failure modes and effects of high pressure core spray systems with FCM. Hossain &Brooks (2008) developed an FCM model that gives an insight into the context of educational software adoption in secondary schools in UK that can help the educational decision makers. Alizadeh& Ghazanfari (2009) enhanced the FCM with chaotic simulated annealing which allows to deal with the cases that experts' ideas insufficient to construct FCM graph. Lee& Ahn (2009) developed a FCM application for e-commerce web based systems whose control designs are not well structured and requires understanding the complex casual relationships among environmental factors. Yaman & Polat (2009) proposed FCM for effect based planning and applied their extended FCM in

military planning case. Papageorgiou et al (2009) applied FCM for cotton yield management in precision farming. Irani et al (2009) benefited from FCM to explore the relationship between knowledge management and organizational learrning by codifying key factors within the case company. Kok (2009) used FCM model to deal with the weak link between qualitative and quantitative scenarios of story-and simulation approach which is a relatively new scenario development technique in the field of environmental sciences. Salmeron (2009) used FCM for modelling critical success factors for an effective selection process of e-learning tehnologies. In another study Bueno & Salmeron (2009) conducted a study aims to benchmark the activation functions in fuzzy cognitive maps. Similarly, Tsadiras (2008) compared the inference capabilities of activation functions in FCM.

Stach et al (2010) tried to speed up the learning process for the large scaled FCMs with the divide and conquer method. FCM was used in the communication between stakeholders and modellers for an water quality and quantity research in as specific region by Vliet et al (2010). Song et al (2010) proposed a four-layer neural network to enhance the learning ability and automatic construction of FCMs. Furfaro (2010) proposed the FCM for the planetary science with his study that identify cryovolcanism on Titan. Salmeron (2010) proposed an innovative and filexible model entitled Fuzzy Grey Cognitive Map that can be adapted multiple meaning- based environments with grey uncertainities. Akgun et al (2010) developed fuzzy integrated vulnerability assesment model based on FCM for critical facilities in combating the terrosim. Trappey et al (2010) proposed a FCM model for improving RFID reverse logistic process. Papageorgiou (2011) developed a new method for decision making in medicine by using the soft computing tools which is based on FCM. Jetter &Schweinfort (2011) developed FCM based scenarios on solar photovoltaic panels to get a better projection. Nunes-Carrera et al (2011) conducted failure modes and effects analysis bu using FCM for the liquid control system in the boiling water reactor. Altay & Kayakutlu (2011) eliminated and prioritized the innovational risk factors for large ,small and medium enterprises by applying

FCM. Beena&Ganguli (2011) focused on the structural damages of the aircraft wings, helicopter rotor blades and tall buildings and divided into five categories damages according to their frequency of occurence and applied to Hebbian Learning supported FCM for structural damage detection by using existing data. Cheah et al (2011) developed a interface called "FCM Constructor" that make the knowledge acquisition procedure easier for fuzzy cognitive map costruction and applied their methodology for product design decision support. Baykasoglu et al (2011) trained FCM with Extended Great Deluge Algorithm and applied the proposed method on the "industrial process control problem" and a simulation model of a job shop to examine the casual realtionships between risks and success. Chytas et al (2011) proposed balanced scorecard methodology by using FCM and revealed the casual links among KPIs and stimulated the impact of each KPI on the other KPIs to adjust targeted performance. Maio et al (2011) studied on a knowledge-based framework for emergency decision support systems by using FCM. Lopolito et al (2011) developed a new methodology based on FCM by evaluating the perceptions of the stakeholders with the purpose of identifying the most suitable policy option under the uncertain environment of decision process of bio-rafinery industry in rural areas. . They basically identified the emergency features and actions ,resource types and weighted casualities between them ,finally stimulated the different emergency cases to see the action to be taken according to situation. Kyriakarakos et al (2012) suggested a combined FCM and petri net approach for better designing and managing energy systems. Salmeron & Gutierrez (2012) used fuzzy grey cognitive maps which is proposed by himself in 2010, in reliability engineering. Salmeron& Papageorgiou (2012) integrated their previous studies and developed fuzzy grey cognitive maps as an extension of FCM and applied their methodolgy in decision support system for radiotherapy treatment planning. In another study Salmeron& Papageorgiou (2012) enhanced the learning process of fuzzy grey cognitive map using non linear hebbian approach and applied their study in determining the treatment variables of cancer therapy and the acceptance level of the final radiation dose to the target volume. Papageorgiou & Froelich (2012) used evolutionary FCMs for multi-step prediction of pulmonary

infection. Salmeron et al (2012) developed an approach combining FCM and TOPSIS techniques that allows to construct, assest and rank the scenarios for any case. Papakostas et al (2012) examined six different types of Hebbian learning algorithms from the literature have been selected to train FCM and compared their training capabilities and reached the result that the active hebbian learning shown best performance. Ghaderi et al (2012) studied on simulation and optimization of market behaviors of generation companies in electricity market by using FCM. Azadeh et al (2012) developed a hybrid fuzzy linear regression and FCM algorithm enables the decision-makers to utilize imprecise and ambiguous data for forecasting and optimization of housing market fluctations. Bevilacqua et al (2012) studied on analysis of the injury events by applying FCM. Büyüközkan &Vardaloğlu (2012) analyzed the collaborative planning forecasting and replenishment success factors using FCMs in retail industry. Froelich et al (2012) applied evolutionary FCM to the long term prediction of prostate cancer. In another study, Papageorgiou et al (2012) focused on the formalization of medical knowledge and traetment guidelines using FCM and developed semantic web tools. One another study Papageorgiou &Kannappan (2012) applied FCM for identification of autism. In the same year, Papageorgiou (2012) developed an FCM software tool for treatment management of uncomplicated urinary tract infection. Chen (2012) identified the decision factors most relevant in increasing repurchase rate for a full-service restaurant by FCM. Mago et al (2012) integrated FCM and cellular automata algorithm applied and its applicability is demonstrated by modelling the spread of human immunodeficiency virus (HIV) in an environment in which injection drug users share paraphernalia. Salmeron (2012) introduced an innovative FCM based method for forecasting artificial emotions and designing an affective decision system. Furfaro et al (2012) developed his study in 2010 and applied evolutionary FCMs for the autonomous real-time landing site selection for Venus and Titan. Giabanelli et al (2012) identified the phsycological determinants of obesity issue by FCM. Ramsey et al (2012) benefited from the Bayesian algorithm for training FCMs of forest responses to deer control. Motlagh et al (2012) proposed FCM based control sytem to built the casual links between the various motion concepts of mobile

robots. Xiao et al (2012) combined the FCM and fuzzy soft sets to deal with supplier selection problem which embraces risky factors. Lee et al (2012) developed a decision making system based on FCM for seleection of dental implant abutments. Glykas (2012) benefited from FCM to overcome with the existing limitations of strategy maps and applied his methodology on two diffrent banks. Meliadou et al (2012) prioritised coastal zone management issuesa trough FCM and applied FCM tool to reveal the objectives and priorities of North Lebanon's coastal productive sector. FCM was used by Kontogianni et al (2012) to elucidate the perceptions of Ukranian people on the Black Sea and applied to evaluate the risk factors and future situation of the ecosystem of Black Sea. Lee & Lee (2012) used FCM to examine the casual relationship between the success factors underlying og expert systems for internet based stock trading systems. Wise et al (2012) used rule-based FCM modelling to predict fishermen's behaviour in a pelagic fishery by investigating the parameters that effect the catched species and the catched quantity. Gray et al (2012) applied FCM to understand and compare the perspectives and differences between the knowledge of stakeholders who mostly take a place in the decision making process of socio-ecological systems. Lee et al (2012) integrated FCM in their study to understand the casuality among the factors that strongly influence the decisions of customers and users in the mobile commerce environment. Ketipi et al (2012) proposed a flexible nonlinear approach to represent casual relationships in FCM and the proposed method allowed FCM to lead a large set of different equilibrium states. Asadzadeh et al (2013) analyzed and investigated health, safety, environment and ergonomics factors by FCM and implemented their study in a large gas rafinery. Lee et al (2013) applied FCM for industrial marketing planning and agent based inference method is preferred to deal with the time lags and the reusability questions of FCM. Papageorgiou et al (2013) used FCM for yield prediction in apples in central Greece and applied Hebbian learning algorithm for the learning stage of the FCM and compared their proposd method wih the other machine learning techniques. Tsadiras & Bassiliades (2013) developed Rule-ML representation to make FCM reusable, transportable; thus, as a result of the FCM simulations are stored in RuleML format , their usage by

other systems became easier. Samarasinghe & Strickert (2013) proposed a FCM based ANN model for public policy decisions on natural hazard mitigation that provide comprehensive view of the system. Zhang et al (2013) used FCM to assess knowledge and attitudes towards coal-mine ecosystems among stakeholders and developed a participatory ecosystem management model for a coal-mine region in China. Lopes et al (2013) develpoed FCM based decision support system to discriminate the diagnoses of alterations in urinary elimination. Facchini et al (2013) used FCM to overcome with the problem of energy efficiency in cellular networks. Kardaras et al (2013) studied on web personalisation and media adaptation in tourism web sites and used FCM to reveal the most preferred features by customers. Huang et al (2013) investigated the elements influencing wind power development and identified the limitations and provided better understanding for policy makers. Mendonça et al (2013) developed an intelligent tool based on FCM to control fermentation process in critical conditions. Kalampakas et al (2013) studied on syntactic recognizability of graphs with fuzzy atribuyes and applied their technique for the recognition of fuzzy cognitive maps. Kontogianni et al (2013) applied FCM to analyze the perception and beliefs about low carbon transport economy of target users' group. Papageorgiou et al (2013) developed a fuzzy cognitive approaches in semantic web framework as a medical decision support systems and implemented their model for urinary tract infection. Knight et al (2014) focused on the fixed points of linear and sigmoidal types of FCM. Azadeh et al (2014) assessed the risk-factors that can obstruct the safety conditions in the working area in a petrochemical plant by using FCM. Kyriakarakos (2014) developed decision support system based on FCM which helps decision makers who are responsible of the planning of local renewable energy sources and integrated their methodology on the web platform. Motlagh et al (2014) benefited from the recurrent structure of FCM to develop application specific adjacency models. Napoles et al (2014) proposed a model based on FCM for analyzing the behavior of the HIV-1 protease protein and studied on the biological casulity among amino-acids of the related protein structure. Irani et al (2014) approached knowledge mapping for the evaluation of information system investments and

benefited from FCM to demonstrate the casual relationships between the factors which have organisational dimensions.

Ahmadi et al (2015) studied on ERP implementation readiness of an organization and used FCM to estimate overall readiness degree of the organization. Azadeh et al (2015) proposed an approach that can assess the impact of leanness factors on each other as well as the impact of the leanness factors on lean production strategy sustaining in an organization. Chen et al (2015) developed FCM based computation approach to estimate the minimum required elevators so as to minimize the eletricity consumption while meeting preidentified service quality. Baykasoglu &Golcuk (2015) developed a novel multiple –attribute decision making model by integrating FCM and hierarchical fuzzy TOPSIS and implemented their model for a startegy selection problem. Lee & Lee (2015) proposed a method to solve the semantic ambiguity problems in different FCMs and improved the experts-based FCM construction. Chen (2015) designed the autonomous agent-based tracing system using FCM to investigate problems through food product usage life cycle for food safety and quality issues. Subramanian et al (2015) proposed an integrated breast cancer risk prediction and management model based on FCM. Wee et al (2015) developed a method for effective root-cause analysis by integrating bayesian belief network and FCM. Galehbakhtiari & Pouryasouri (2015) proposed FCM approach in modeling consumer motivations for online community participation. There is a list below including the studies of fuzzy cognitive map.

Table 5.1.Applications of Fuzzy Cognitive Map

Item	Year	Article Title	Author(s)	Journal Title	Application Area
1	1986	Fuzzy Cognitive Maps	Kosko B.	International Journal of Man-Machine Studies 24 (1986) 65-75	First Introduction of the FCM
2	1996	Using Fuzzy Cognitive Maps as a System Model for Failure Modes and Effects Analysis	Pelaez E.C., Bowles J.B.	Information Sciences 88, 177-199 (1996)	Engineer. App.
3	1997	A Computer-Based System for Supporting Decisions for Tunneling in Rock Under Conditions of Uncertainity	Kalamaras G.S.	Int. J. Rock Mech. & Min. Sci., 34:3-4, pp. 147.	Environment /Geo./Eco.
4	1998	Application of Fuzzy Cognitive Maps to Factors Affecting Slurry Rheology	Banini G. A., Bearman R.A.	International Journal of Mineral Processing, 52, pp. 233-244	Environment /Geo./Eco.
5	1999	The Use of Fuzzy Cognitive Maps to Simulate the Information Systems Strategic Planning Process	Kardaras D., Karakostas B.	Information and Software Technology 41 (1999) 197–210	Strategic Planning
6	1999	Fuzzy Cognitive Maps: A Model for Intelligent Supervisory Control Systems	Stylios C.D., Groumpos P.P	Computers in Industry 39 1999. 229–238	Engineer. App.

7	2000	Fuzzy Cognitive Map for The Design of EDI Controls	Lee S., Han I.,	Information & Management 37 (2000) 37±50	Engineer. App.
8	2002	Fuzzy Cognitive Map Approach to Web-Mining Inference Amplification	Lee K.C., Kim J.S.,Chung N. H., Kwon S.J.	Expert Systems with Applications 22 (2002) 197-211	Information Technology
9	2002	Agent That Models, Reasons and Makes Decisions	Miao C.Y., Goh A., Miao Y., Yang Z.H.	Knowledge-Based Systems 15 (2002) 203-211	Information Technology
10	2003	A Fuzzy Cognitive Map Approach to Differential Diagnosis of Specific Language Impairment	Georgopolous V.C., Malandraki G.A., Stylios C.D	Artificial Intelligence in Medicine 29 (2003) 261–278	Medicine
11	2003	Predicting Plant Species Richness in a Managed Forest	Skov F., Svenning J.C.,	Forest Ecology and Management 180 (2003) 583–593	Environment /Geo./Eco.
12	2004	A Fuzzy Cognitive Map Approach to Support Urban Design	Xirogiannisa G., Stefanoua J., Glykas M.	Expert Systems with Applications 26 (2004) 257–268	Environment /Geo./Eco.
13	2004	Ecological Models Based on People's Knowledge: A Multi-Step Fuzzy Cognitive Mapping Approach	Özesmi U., Özesmi S.L.	Ecological Modelling 176 (2004) 43–64	Environment /Geo./Eco.
14	2004	Using Fuzzy Cognitive Map for the Relationship Management in Airline Service	Kang I., Lee S., Choi J.	Expert Systems with Applications 26 (2004) 545–555	Management/ Desic. Mak.
15	2004	Computer Aided Fuzzy Medical Diagnosis	Innocent P.R., John R.I.	Information Sciences 162 (2004) 81–104	Medicine
16	2005	Fuzzy Cognitive Maps for Issue Identification in a Water Resources Conflict Resolution System	Giordano R., Passarella G., Uricchio V.F., Vurro M.	Physics and Chemistry of the Earth 30 (2005) 463–469	Environment /Geo./Eco.
17	2006	Fuzzy Cognitive Maps for Stereovision Matching	Pajaresa G., Cruz J.M.	Pattern Recognition 39 (2006) 2101 – 2114	Engineer. App.

18	2006	A Soft Computing Method for Multi-Criteria Decision Making with Dependence and Feedback	Yu R., Tzeng G.H	Applied Mathematics and Computation 180 (2006) 63–75	Management/ Desic. Mak.
19	2006	Automatic Generation of Document Semantics for The E-Science Knowledge Grid	Zhuge H., Luo X.	The Journal of Systems and Software 79 (2006) 969–983	Information Technology
20	2007	A Novel Maximum Power Point Tracking Method for PV Systems Using Fuzzy Cognitive Networks (FCN)	Karlis A.D., Kottas T.L., Boutalis Y.S.	Electric Power Systems Research 77 (2007) 315–327	Engineer. App.
21	2007	Integrating Conventional Science and Aboriginal Perspectives on Diabetes Using Fuzzy Cognitive Maps	Giles B.G, Findlay C.S., Haasa G., LaFrancec B., Laughingd W., Pembletone S.	Social Science & Medicine 64 (2007) 562–576	Medicine
22	2007	Modelling IT projects success with Fuzzy Cognitive Maps	Rodriguez-Repiso L., Setchi R., Salmeron J.L.	Expert Systems with Applications 32 (2007) 543–559	Strategic Planning
23	2007	Assessment of Human Reliability Factors: A Fuzzy Cognitive Maps Approach	Bertolini M.,	International Journal of Industrial Ergonomics 37 (2007) 405–413	Engineer. App.
24	2007	A Cognitive Approach for Agent-Based Personalized Recommendation	Miao C., Yang Q., Fang H., Goh A.	Knowledge-Based Systems 20 (2007) 397–405	Information Technology
25	2007	Intelligent Modeling of E-Business Maturity	Xirogiannis G., Glykas M.,	Expert Systems with Applications 32 (2007) 687–702	Information Technology
26	2007	Causal Knowledge-Based Design of EDI Controls: An Explorative Study	Lee K. C., Lee S.	Computers in Human Behavior 23 (2007) 628–663	Engineer. App.

27	2008	Emergency Management for a Nuclear Power Plant Using Fuzzy Cognitive Maps	Espinosa-Paredes G., Nuñez-Carrera A., A.L. Laureano-Cruces A.L.,Vázquez-Rodríguez A., Espinosa-Martinez E.G	Annals of Nuclear Energy 35 (2008) 2387–2396	Environment /Geo./Eco.
28	2008	Fuzzy Cognitive Map Modelling Educational Software Adoption	Hossain S., Brooks L.	Computers & Education 51 (2008) 1569–1588	Education
29	2008	Brain Tumor Characterization Using The Soft Computing Technique of Fuzzy Cognitive Maps	Papageorgiou E.I., Spyridonos P.P., Glotsos D. Th., Stylios C.D., Ravazoula P., Nikiforidis G.N., Groumpos P.P.	Applied Soft Computing 8 (2008) 820–828	Medicine
30	2008	Forward–Backward Analysis of RFID-Enabled Supply Chain Using Fuzzy Cognitive Map and Genetic Algorithm	Kim M.C., Kim C. O., Hong S.R., Kwon I.H.	Expert Systems with Applications 35 (2008) 1166–1176	Engineer. App.
31	2008	Fuzzy Cognitive Map Architectures for Medical Decision Support Systems	Stylios C.D., Georgopoulos V.C., Malandraki G.A., Chouliara S.	Applied Soft Computing 8 (2008) 1243–1251	Management/ Desic. Mak.
32	2008	Using Fuzzy Cognitive Time Maps for Modeling and Evaluating Trust Dynamics in The Virtual Enterprises	Wei Z., Lu L., Yanchun Z.	Expert Systems with Applications 35 (2008) 1583–1592	Information Technology
33	2008	Cakes-Nego: Causal Knowledge-Based Expert System for B2B Negotiation	Lee K. C., Kwon S.	Expert Systems with Applications 35 (2008) 459–471	Management/ Desic. Mak.
34	2008	Intelligent Impact Assessment of HRM to The Shareholder Value	Xirogiannis G., Chytas P., Glykas M., Valiris G.	Expert Systems with Applications 35 (2008) 2017–2031	Management/ Desic. Mak.
35	2009	A Fuzzy Cognitive Map Approach for Effect-Based Operations:An Illustrative Case	Yaman D., Polat S.	Information Sciences 179 (2009) 382–403	Military

36	2009	Application of Fuzzy Cognitive Maps for Cotton Yield Management in Precision Farming	Papageorgiou E., Markinos A., Gemptos T.	Expert Systems with Applications 36 (2009) 12399–12413	Environment /Geo./Eco.
37	2009	Augmented Fuzzy Cognitive Maps for Modelling LMS Critical Success Factors	Salmeron J. L.	Knowledge-Based Systems 22 (2009) 275–278	Management/ Desic. Mak.
38	2009	Fuzzy Cognitive Map Based on Structural Equation Modeling for The Design of Controls in Business-to-Consumer E-Commerce Web-Based Systems	Lee S., Ahn H.	Expert Systems with Applications 36 (2009) 10447–10460	Information Technology
39	2009	Modeling of the High Pressure Core Spray Systems with Fuzzy Cognitive Maps for Operational Transient Analysis in Nuclear Power Reactors	Espinosa-Paredes G., Nunez-Carrera A., Vazquez-Rodriguez A., Espinosa-Martinez E.G.	Progress in Nuclear Energy 51 (2009) 434–442	Environment /Geo./Eco.
40	2009	The Potential of Fuzzy Cognitive Maps for Semi-Quantitative Scenario Development, with an Example from Brazil	Kok K.	Global Environmental Change 19 (2009) 122–133	Environment /Geo./Eco.
41	2009	Mapping Knowledge Management and Organizational Learning in Support Organizational Memory	Irani Z., Sharif A.M., Love P.E.D.	Int. J.Production Economics122(2009)200–215	Management/ Desic. Mak.
42	2010	Fuzzy Integrated Vulnerability Assessment Model for Critical Facilities in Combating The Terrorism	Akgun I., Kandakoglu A., Ozok A.F.	Expert Systems with Applications 37 (2010) 3561–3573	Military

43	2010	Linking Stakeholders and Modellers in Scenario Studies: The Use of Fuzzy Cognitive Maps as A Communication and Learning Tool	Vliet M.V., Kok K., Veldkamp T	Futures 42 (2010) 1–14	Environment /Geo./Eco.
44	2010	Identification of Cryovolcanism on Titan Using Fuzzy Cognitive Maps	Furfaro R., Kargel J.S., Lunine J.I., Fink W., Bishop M.P.	Planetary and Space Science 58 (2010)761–779	Environment /Geo./Eco.
45	2010	Genetic Algorithm Dynamic Performance Evaluation for RFID Reverse Logistic Management	Trappey A.J.C. , Trappey C.V., Wub C.R.	Expert Systems with Applications 37 (2010) 7329–7335	Engineer. App.
46	2011	A New Methodology for Decisions in Medical Informatics Using Fuzzy Cognitive Maps Based on Fuzzy Rule-Extraction Techniques	Papageorgiou E.I.	Applied Soft Computing 11 (2011) 500–513	Management/ Desic. Mak.
47	2011	Building Scenarios with Fuzzy Cognitive Maps: An Exploratory Study of Solar Energy	Jetter A., Schweinfort W.	Futures 43 (2011) 52–66	Environment /Geo./Eco.
48	2011	Failure Analysis of the Stand-by Liquid Control System for a Boiling Water Reactor with Fuzzy Cognitive Maps	Núnez-Carrera A., Espinosa-Paredes G., Cruz-Esteban H.	Nuclear Engineering and Design 241 (2011) 4004– 4012	Engineer. App.
49	2011	Fuzzy Cognitive Mapping in Factor Elimination: A Case Study for Innovative Power and Risks	Altay A., Kayakutlu G.	Procedia Computer Science 3 (2011) 1111–1119	Management/ Desic. Mak.
50	2011	Structural Damage Detection Using Fuzzy Cognitive Maps and Hebbian Learning	Beena P., Ganguli R.,	Applied Soft Computing 11 (2011) 1014–1020	Engineer. App.
51	2011	Systematic Causal Knowledge Acquisition Using FCM Constructor for Product Design	Cheah W.P., Kim Y. S., Kim K.Y.,Yang H.J.	Expert Systems with Applications 38 (2011) 15316–15331	Engineer. App.

52	2011	Training Fuzzy Cognitive Maps via Extended Great Deluge Algorithm with Applications	Baykasoglu A., Durmusoglu Z.D.U, Kaplanoglu V.	Computers in Industry 62 (2011) 187–195	Engineer. App.
53	2011	Modeling The Bio-Refinery Industry in Rural Areas: A Participatory Approach for Policy Options Comparison	Lopolito A., Nardone G., Prosperi M.,Sisto R.,Stasi A.	Ecological Economics 72 (2011) 18–27	Environment /Geo./Eco.
54	2011	A Proactive Balanced Scorecard	Chytas P., Glykas M., George Valiris G.	International Journal of Information Management 31 (2011) 460– 468	Business
55	2011	A Knowledge-Based Framework for Emergency DSS	Maio C.D., Fenza G., Gaeta M., Loia V., Orciuoli F.	Knowledge-Based Systems 24 (2011) 1372–1379	Management/ Desic. Mak.
56	2012	A Fuzzy Cognitive Maps–Petri Nets Energy Management System for Autonomous Polygeneration Microgrids	Kyriakarakos G., Dounis A.I., Arvanitis K.G.,Papadakis G.	Applied Soft Computing 12 (2012) 3785–3797	Environment /Geo./Eco.
57	2012	A Fuzzy Grey Cognitive Maps-Based Decision Support System for Radiotherapy Treatment Planning	Salmeron J.L., Papageorgiou E.I.	Knowledge-Based Systems 30 (2012) 151–160	Medicine
58	2012	A Hybrid Fuzzy Regression-Fuzzy Cognitive Map Algorithm for Forecasting and Optimization of Housing Market Fluctuations	Azadeh A., Ziaei B., Moghaddam M.	Expert Systems with Applications 39 (2012) 298–315	Engineer. App.
59	2012	Analysis of Injury Events with Fuzzy Cognitive Maps	Bevilacqua M., Ciarapica F.E., Mazzuto G.	Journal of Loss Prevention in the Process Industries 25 (2012) 677e685	Management/ Desic. Mak.
60	2012	Analyzing of CPFR Success Factors Using Fuzzy Cognitive Maps in Retail Industry	Büyüközkan G., Vardaloglu Z.	Expert Systems with Applications 39 (2012) 10438–10455	Engineer. App.

61	2012	Application of Evolutionary Fuzzy Cognitive Maps to The Long-Term Prediction of Prostate Cancer	Froelich W., Papageorgiou E.I.,Samarinas M.,Skriapas K.	Applied Soft Computing 12 (2012) 3810–3817	Medicine
62	2012	Autonomous Real-Time Landing Site Selection for Venus and Titan Using Evolutionary Fuzzy Cognitive Maps	Furfaro R., Fink W., Kargel J.S.	Applied Soft Computing 12 (2012) 3825–3839	Environment /Geo./Eco.
63	2012	Behavioral Simulation and Optimization of Generation Companies in Electricity Markets by Fuzzy Cognitive Map	Ghaderi S.F., Azadeh A., Nokhandan B. P., Fathi E.	Expert Systems with Applications 39 (2012) 4635–4646	Engineer. App.
64	2012	Formalization of Treatment Guidelines Using Fuzzy Cognitive Maps and Semantic Web Tools	Papageorgiou E.I., Roo J.D., Huszka C., Colaert D.	Journal of Biomedical Informatics 45 (2012) 45–60	Medicine
65	2012	Fuzzy Cognitive Map Ensemble Learning Paradigm to Solve Classification Problems: Application to Autism Identification	Papageorgioua E.I., Kannappan A.	Applied Soft Computing 12 (2012) 3798–3809	Medicine
66	2012	Fuzzy Cognitive Map for Optimizing Solutions for Retaining Full-Service Restaurant Customer	Chen S.C.	Procedia - Social and Behavioral Sciences 57 (2012) 47 – 52	Management/ Desic. Mak.
67	2012	Fuzzy Cognitive Maps and Cellular Automata: An Evolutionary Approach for Social Systems Modelling	Mago V.K., Bakker L.,Papageorgiou E.I., Alimadad A., Borwein P., Dabbaghian V.	Applied Soft Computing 12 (2012) 3771–3784	Medicine
68	2012	Fuzzy Cognitive Maps for Artificial Emotions Forecasting	Salmeron J.L.	Applied Soft Computing 12 (2012) 3704–3710	Information Technology

69	2012	Fuzzy Cognitive Map Software Tool for Treatment Management of Uncomplicated Urinary Tract Infection	Papageorgiou E.I.	Computer Methods and Programs in Biomedicine 105(2012) 233-245	Medicine
70	2012	Fuzzy Grey Cognitive Maps in Reliability Engineering	Salmeron J.L.,Gutierrez E.	Applied Soft Computing 12 (2012) 3818–3824	Engineer. App.
71	2012	Multi-Step Prediction of Pulmonary Infection with The Use of Evolutionary Fuzzy Cognitive Maps	Papageorgiou E.I., Froelich W.	Neurocomputing 92(2012)28–35	Medicine
72	2012	A Fuzzy Cognitive Map of the Psychosocial Determinants of Obesity	Giabbanelli P. J.,Torsney-Weira T., Mago V.K.	Applied Soft Computing 12 (2012) 3711–3724	Medicine
73	2012	An Approximate Bayesian Algorithm for Training Fuzzy Cognitive Map Models of Forest Responses to Deer Control in a New Zealand Adaptive Management Experiment	Ramsey D.S.L., Forsyth D.M., Veltman C.J., Nicola S. J., Todd C.R., Allen R.B., Allen W.J., Bellingham P.J., Richardson S.J., Jacobson C.L.,Barker R.J.	Ecological Modelling 240 (2012) 93– 104	Environment /Geo./Eco.
74	2012	An Expert Fuzzy Cognitive Map for Reactive Navigation of Mobile Robots	Motlagh O.,Tang S.H.,Ismail N.,.Ramli A.R	Fuzzy SetsandSystems 201 (2012)105–121	Engineer. App.
75	2012	An Integrated FCM and Fuzzy Soft Set for Supplier Selection Problem Based on Risk Evaluation	Xiao Z., Chen W., Li L.	Applied Mathematical Modelling 36 (2012) 1444–1454	Management/ Desic. Mak.
76	2012	Development of a Decision Making System for Selection of Dental Implant Abutments Based on The Fuzzy Cognitive Map	Lee S., Yang J., Han J.	Expert Systems with Applications 39 (2012) 11564–11575	Medicine

77	2012	Performance Measurement Scenarios with Fuzzy Cognitive Strategic Maps	Glykas M.,	International Journal of Information Management 32 (2012) 182– 195	Business
78	2012	Prioritising Coastal Zone Management Issues through Fuzzy Cognitive Mapping Approach	Meliadou A., Santoro F., Nader M.R., Dagher M.A., Indary S A., Salloum B.A.	Journal of Environmental Management 97 (2012) 56-68	Environment /Geo./Eco.
79	2012	Risks for the Black Sea Marine Environment as Perceived by Ukrainian Stakeholders: A Fuzzy Cognitive Mapping Application	Kontogianni A., Papageorgiou E.,Salomatina L., Skourtos M., Zanou B.	Ocean & Coastal Management 62 (2012) 34-42	Environment /Geo./Eco.
80	2012	A Causal Knowledge-Based Expert System for Planning an Internet-Based Stock Trading System	Lee K.C., Lee S.	Expert Systems with Applications 39 (2012) 8626–8635	Business
81	2012	Qualitative Modelling of Fishermen's Behaviour in a Pelagic Fishery	Wise L., Murta A.G., Carvalho J.P., Mesquita M.	Ecological Modelling 228 (2012) 112– 122	Environment /Geo./Eco.
82	2012	Modeling the Integration of Stakeholder Knowledge in Social–Ecological Decision-Making: Benefits and Limitations to Knowledge Diversity	Gray S., Chan A., Clark D.,Jordan R.,	Ecological Modelling 229 (2012) 88– 96	Environment /Geo./Eco.
83	2012	Agent Based Mobile Negotiation for Personalized Pricing of Last Minute Theatre Tickets	Lee K.C., Lee H., Lee N.	Expert Systems with Applications 39 (2012) 9255–9263	Business
84	2013	Assessment and Improvement of Integrated HSE and Macroergonomics Factors by Fuzzy Cognitive Maps: The Case of a Large Gas Refinery	Asadzadeh S.M. , Azadeh A., Negahban A., Sotoudeh A.	Journal of Loss Prevention in the Process Industries 26 (2013) 1015-1026	Environment /Geo./Eco.

85	2013	An Agent-Based Fuzzy Cognitive Map Approach to The Strategic Marketing Planning for Industrial Firms	Lee K.C., Lee H., Lee N., Lim J.	Industrial Marketing Management 42 (2013) 552–563	Business
86	2013	Yield Prediction in Apples Using Fuzzy Cognitive Map Learning Approach	Papageorgiou E.I.,Aggelopoulou K.D., Gemtos T.A., Nanos G.D.	Computers and Electronics in Agriculture 91 (2013) 19–29	Management/ Desic. Mak.
87	2013	Mixed-Method Integration and Advances in Fuzzy Cognitive Maps for Computational Policy Simulations for Natural Hazard Mitigation	Samarasinghe S., Strickert G.	Environmental Modelling & Software 39 (2013) 188-200	Environment /Geo./Eco.
88	2013	Human Attitudes in Environmental Management: Fuzzy Cognitive Maps and Policy Option Simulations Analysis for a Coal-Mine Ecosystem in China	Zhang H., Song J., Su C., He M.	Journal of Environmental Management 115 (2013) 227-234	Environment /Geo./Eco.
89	2013	Fuzzy Cognitive Map in Differential Diagnosis of Alterations in Urinary Elimination: A Nursing Approach	Lopes M.H.B.M., Ortega N.R.S., Silveira P.S.S., Massad E., Rosângela Higa R., Marin H.F.	Internatonal Journal of Medical Informatics 82 (2013) 201-208	Medicine
90	2013	Dynamic Green Self-Configuration of 3G Base Stations Using Fuzzy Cognitive Maps	Facchini C., Holland O., Granelli F., Fonseca N.L.S., Aghvami H.	Computer Networks 57 (2013) 1597–1610	Telecominati cations
91	2013	Content Presentation Personalisation and Media Adaptation in Tourism Web Sites Using Fuzzy Delphi Method and Fuzzy Cognitive Maps	Kardaras D.K., Karakostas B., Mamakou X.J.	Expert Systems with Applications 40 (2013) 2331–2342	Information Technology

92	2013	Application of a Fuzzy Cognitive Map Based on a Structural Equation Model for The Identification of Limitations to The Development of Windpower	Huang S.C., Lo S.L., Lin Y.C.	Energy Policy 63 (2013)851–861	Environment /Geo./Eco.
93	2013	A Dynamic Fuzzy Cognitive Map Applied to Chemical Process Supervision	Mendonça M., Angelico B., Arruda L.V.R., Neves F.	Engineering Applications of Artificial Intelligence 26(2013)1199–1210	Engineer. App.
94	2013	Revealing Market Adaptation to a Low Carbon Transport Economy: Tales of Hydrogen Futures as Perceived by Fuzzy Cognitive Mapping	Kontogianni A., Tourkolias C., Papageorgiou E.I.	International Journal of Hydrogen Energy 38 (2013) 709-722	Environment /Geo./Eco.
95	2013	Application of Probabilistic and Fuzzy Cognitive Approaches in Semantic Web Framework for Medical Decision Support	Papageorgioua E.I., Huszka C., Roo J.D., Douali N., Jaulent M.C., Colaert D.	Computer Methods and Programs in Biomedicine 112 (2013) 580-598	Medicine
96	2014	Assessment of Resilience Engineering Factors in High-Risk Environments by Fuzzy Cognitive Maps: A Petrochemical Plant	Azadeh A., Salehi V., Arvan M., Dolatkhah M.	Safety Science 68 (2014) 99–107	Environment /Geo./Eco.
97	2014	A Fuzzy Cognitive Maps Decision Support System for Renewables Local Planning	Kyriakarakos G., Patlitzianas K., Damasiotis M., Papastefanakis D.	Renewable and Sustainable EnergyReviews 39 (2014)209–222	Environment /Geo./Eco.
98	2014	Two-Steps Learning of Fuzzy Cognitive Maps for Prediction and Knowledge Discovery on The HIV-1 Drug Resistance	Nápoles G., Grau I., Bello R., Grau R.	Expert Systems with Applications 41 (2014) 821–830	Medicine
99	2014	Visualising a Knowledge Mapping of Information Systems Investment	Irani Z., Amir Sharif A., Kamal M.M., Love P.E.D.	Expert Systems with Applications 41 (2014) 105–125	Information Technology

		Evaluation			
100	2015	Optimizing ERP Readiness Improvements under Budgetary Constraints	Ahmadi S., Yeh C.H., Martin R., Papageorgiou E.	Int. J.Production Economics161(2015)105–115	Engineer. App.
101	2015	Leanness Assessment and Optimization by Fuzzy Cognitive Map and Multivariate Analysis	Azadeh A., Zarrin M., Abdollahi M., Noury S., Farahmand S.	Expert Systems with Applications 42 (2015) 6050–6064	Engineer. App.
102	2015	FCM Based Hybrid Evolutionary Computation Approach for Optimization Power Consumption by Varying Cars in EGCS	Chen T.C., Lee A.C., Huang S.L.	Applied Mathematical Modelling 764 -765 (2015) 1370-1374	Energy Management
103	2015	Development of a Novel Multiple-Attribute Decision Making Model via Fuzzy Cognitive Maps and Hierarchical Fuzzy TOPSIS	Baykasoglu A., Gölcük I.	Information Sciences 301 (2015) 75–98	Strategic Planning
104	2015	Autonomous Tracing System for Backward Design in Food Supply Chain	Chen R. Y.	Food Control 51 (2015) 70-84	Business
105	2015	An Integrated Breast Cancer Risk Assessment and Management Model Based on Fuzzy Cognitive Maps	Subramanian J., Karmegam A., Papageorgiou E., Papandrianos N., Vasukie A.	Computer Methods and Programs in Biomedicine 118 (2015) 280-297	Medicine
106	2015	A Method for Root Cause Analysis with a Bayesian Belief Network and Fuzzy Cognitive Map	Wee Y.Y., Cheah W.P., Tan S.C., Wee K.	Expert Systems with Applications 42 (2015) 468–487	Engineer. App.
107	2015	A Hermeneutic Phenomenological Study of Online Community Participation:Applications of Fuzzy Cognitive Maps	Galehbakhtiari S., Pouryasouri T.H.	Computers in Human Behavior 48 (2015) 637–643	Information Technology

5.2. Methodology of FCM

As it is explained before, FCM basically consist of two main structure: nodes (concepts) and arcs (links which respresents the relationships among the concepts). FCM nodes are named by such concepts forming the set of concepts $C = \{C_1, C_2, \ldots, C_n\}$ and arcs (C_j, C_i) are oriented and represent causal links between concepts; that is how concept Cj causes concept Ci (Papageorgiou, 2011). Each arc has a weight which expresses direction and the magnitude – influence degree- of the relationship among the concepts. Consideration of the magnitudes of the relationships between the concepts is the most important difference between traditional cognitive maps and fuzzy cognitive maps. According to Kosko (1992), FCM can be described by a connection matrix and the activation levels of its nodes can be represented as a state vector, whereby simple vector-matrix calculations allow extension to neural or dynamical systems techniques (Kontogianni et al, 2013). The development method of the FCM not only determines the number and type of concepts making up the FCM, assigns linguistic weights from experts and combines them, but it continues a step further (Azadeh et al, 2015). In order to describe the relationship between the concepts, experts use linguistic terrms such as “strong”, “weak”, “negatively medium” as in the Table 5.2.

Table 5.2. States of Set T (Ahmadi et al, 2015)

Fuzzy Membership Function (Triangular)	Triangular Membership Region
μ_{nvs} = negatively very strong	(-1, -1, -0.75)
μ_{ns} = negatively strong	(-1, -0.75, -0.5)
μ_{nm} = negatively medium	(-0.75, -0.5, -0.25)
μ_{nw} = negatively weak	(-0.5, -0.25, 0)
μ_{z} = zero	(-0.25, 0, 0.25)
μ_{pw} = positively weak	(0, 0.25, 0.5)
μ_{pm} = positively medium	(0.25, 0.5, 0.75)
μ_{ps} = positively strong	(0.5, 0.75, 1)
μ_{pvs} = positively very strong	(0.75, 1, 1)

The linguistic variables identified by experts are aggregated with SUM method and obtained overall weight of the casual relationship. Finally this aggregated linguistic variable is transformed into numerical value within the interval of [-1,1] with the defuzzfication method. The Centre of Gravity Method has been chosen as defuzzfication method in our study by using Equation (1) :

$$wij = \frac{\int \mu i(x) x \, dx}{\int \mu i(x) dx} \quad (1)$$

Where *wij* is the defuzzified weight and the $\mu i(x)$ is the aggregated membership function.

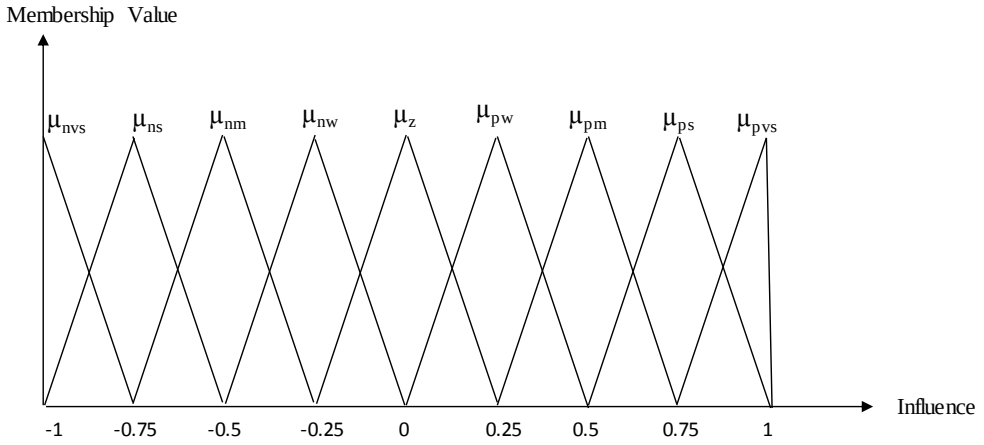


Figure 5.1 : The Membership Function

There are three possible realationships between concepts (Yaman & Polat, 2009):

- $W_{ij} > 0$ indicates positive casuality between concepts C_i and C_j. That is, an increase (decrease) in the value of C_i leads to an increase (decrease) in the value of C_j.
- $W_{ij} < 0$ indicates negative casuality between concepts C_i and C_j. That is, an increase (dicrease) in the value of C_i leads to an decrease (increase) in the value of C_j.
- $W_{ij} = 0$ indicates no relationship between concepts C_i and C_j.

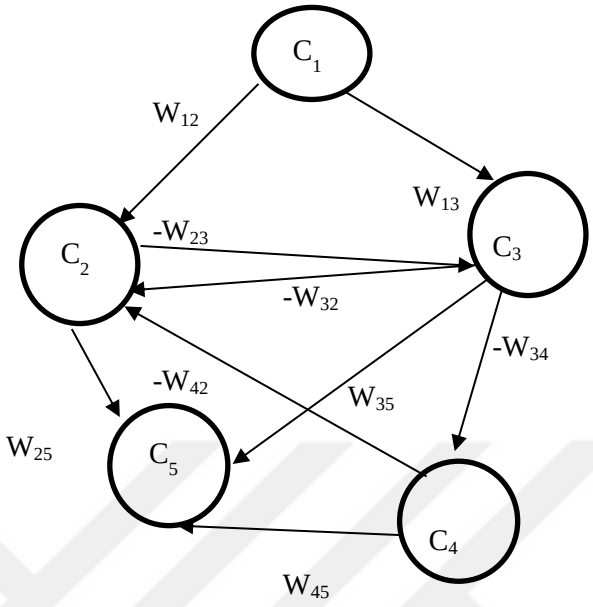


Figure 5.2. A Simple Fuzzy Cognitive Map

At each iteration, the value (also called "activation level") of concept C_i is computed with the following Equation (2):

$$A_i^{t+1} = f\left(\sum_{j=1}^{n} A_j^t wji\right) \qquad (2)$$

where A_i^{t+1} denotes the value of concept C_i at the simulation step *(t+1)*, A_j^t denotes the value of concept C_j at the simulation step *t*, *wji* represents the fuzzy weight between two concepts, and f is the treshold function that transform the output value into a value within the interval of [0,1] that a concept can take.

The treshold function can vary according to structure of the case that studien on. Tsadiras (2008) compared the inference capabilities of three most commonly used threshold functions: binary, trivalent, sigmoid functions. These functions can shortly be expalined as follows:

(1) The sign function

Basically, ecah concept can be either activated or not activated.

$$f(x) = \begin{cases} -x, & x < 0 \\ x, & x \geq 0 \end{cases}$$

(2) The trivalent function

When the activation level of concept Ci equals 1, it means that this concept increases, when the activation level equals -1, it means that the concept decreases, and when the activation level equals to 0, it means that the concept remain stable (Tsadiras, 2008).

$$f(x) = \begin{cases} -1, & x \leq -0.5, \\ 0, & -0.5 < x < 0.5, \\ 1, & x \geq 0.5, \end{cases}$$

(3) The sigmoid function

The concept can take an value within the interval [-1, 1].

$$f(x) = \tanh(x)$$

In our study , the sigmoid function will be applied. At this point, it is fair to mention the reasons of this choice by referring from the study of (Tsadiras, 2008):

- While the binary FCMs can only represent an increase of a concept or a stable concept ,trivalent and sigmoid FCMs can represent increase or decrease of a concept and also stable concept,
- While binary and trivalent FCMs can not represent the degree of an increase or decrease of a concept, sigmoid FCMs ,by allowing neuron's

activation level to take values from the whole interval [-1, 1], can represent also the degree of an increase or a decrease of a concept,

- Finally, in sigmoid FCMs, small changes in the initial state can lead to a dramatic change of the final state of the FCM.

Due to the all these reasons, the superiority of the sigmoid function is considered and chosen for the proposed model.

When we return to the starting point (Eq. 2) ,for simplicity , *A* is the state vector in the form of *1 x n* comprising the values of the *n* concept. W is the *n x n* connection or adjacency matrix that represents the casuality degree of the relationships among the concepts. The algorithm of applying weighted FCM can be seen in Figure 5.4

E=

	C_1	C_2	C_3	C_4	C_5
C_1	0	W_{12}	W_{13}	0	0
C_2	0	0	W_{23}	0	W_{25}
C_3	0	$-W_{32}$	0	$-W_{34}$	W_{35}
C_4	0	$-W_{42}$	0	0	W_{45}
C_5	0	0	0	0	0

where $-1 \leq W_{ij} \leq 1$

Figure 5.3 : The Adjacency Matrix

At each iteration the concepts take different values and are updated due to interaction among the concepts. This interaction goes on until the FCM model (Papageorgiou, 2008) :

- Reaches an equilibrium at a fixed point,

- Exhibits limit cycle behavior, where the output values are falling in a loop under a specific- time period,
- Exhibits a chaotic behavior, where each concept value is reaching a variety of numerical values in a non-deterministic, random way.

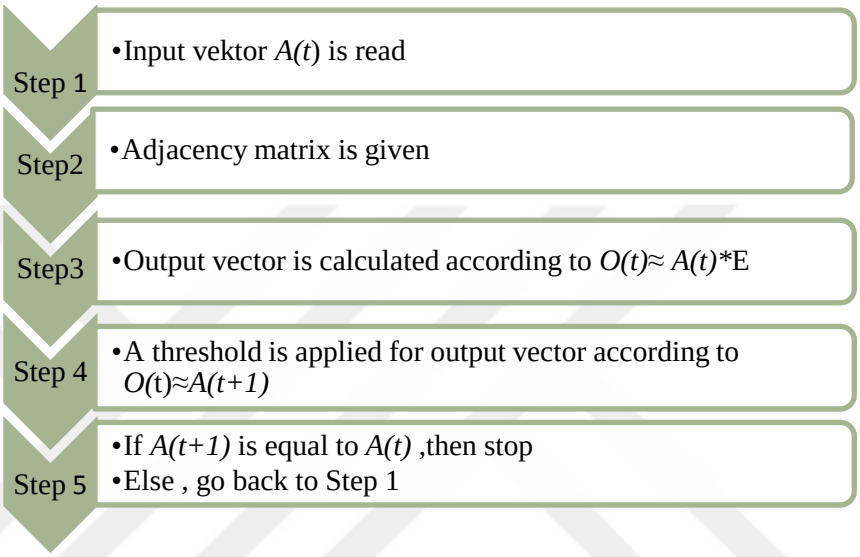


Figure 5.4: Algorithm of Applying Weighted FCM (Azadeh et al, 2015)

5.3. Construction of FCMs

5.3.1. Data Acquistion

The development and construction method of FCM is of great importance for its potential to sufficiently model a system (Papageorgiou et al, 2009).

There are several techniques for constructing an FCM which can be divided into three classes:

- Construction methods which completely depend on the experts' knowledge,

- Construction methods which partly depend on the experts' knowledge and then use mathematical analysis to construct the FCM model, and
- Construction methods where the influential factors (the nodes) are decided by human experts but the relationships and strength of relationships between factors are based on historical data (Ahmadi et al, 2015).

In our study, the first technique will be applied. This tehchnique is also known manual FCM construction technique. The experts come together and identify the number and the kind of the key concepts (nodes) that describe the system behavior. As this step can be carried on with brainstorming , the knowledge of the experts can be gathered by case-based questionnaires or face-to-face inverviews. Experts who have good knowledge and background on the system behavior evaluate the interrelationships between the factors and answer the question of which concepts effects which concepts. As they decide the existence of the relationships between the concepts they identify the direction of the relationship such as "posisive" or "negative" , "no relationship". Then, they evaluate the magnitude of the relationships by expressing with the lingusitic terms such as "positive strong", "negative weak" etc.

5.3.2. Initial Matrix of Supporting Factors (IMS)

After identiftication of the magnitudes of the relationships between concepts, determined linguistic values are gathered in the form of nxn matrix where n refers the number of the concepts. The evaluation of the each expert is transformed into a matrix which is in the form of nxn, thus *Initial Matrix of Supporting Factors (IMS)* is obtained.

5.3.3. Aggregated Matrix of Supporting Factors (AMS)

Since each expert assigns a linguistic term for one connection, there are number of identified weights as the number of experts for one interconnection.
Then, the inferred linguistic weights for each one interconnection are aggregated fuzzy logic method of SUM. Eventually,an aggregated linguistic weight is produced for each interconnection. Therefore, *Aggregated Matrix of Supporting Vectors* (AMS) is obtained.

For the aggregation procedure of the weights, in their study, Stylios & Groumpos (2004) pointed out some important steps. If M experts evaluate the interconnections between the concepts , at least M/3 of the experts have to fully agree with their suggestions therefore the average weight of interconnection is calculated. One another theory that is pointed out by Stylios & Groumpos (2004), if for one interconnection the M experts have suggested more than 2M/3 weights, which do not belong to the same neighborhood, the aggregated weight does not express an overall suggestion.

5.3.4. Weighted Matrix of Supporting Factors (WMS)

In the last step, overall value is transformed into numerical weight within the interval [-1, 1] by using a defuzzfication method. As it is mentioned before, Centre of Gravity Method (COG) will be used in our study (Eq. 1). At the end of this process the *Weighted Matrix of Supporting Vectors* is obtained. The FCM construction procedure can also be viewed in detail in Figure 5.5.

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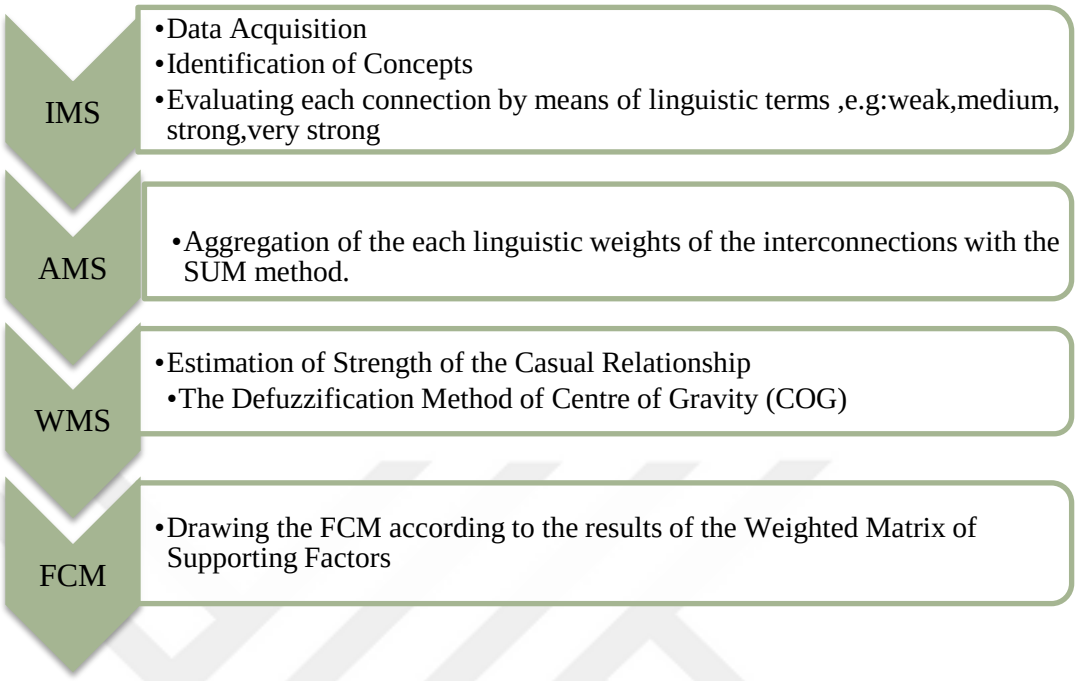

Figure 5.5: The Construction Steps of FCM

6. MODELLING THE TELEVISION DRAMA SUCCESS FACTORS USING FCM

6.1. Identification of The Supporting Factors and Obtaining IMS

To get the initial matrix of strengths, it is necessary to aquire the data and the identify the concepts as shown in the Figure (5.5). When the construction procedure of FCM is explained, three main techniques to identify the concepts had been listed. In our study, we apply the first one which is based on completely depend on experts knowledge. Our expert team consists of one media planner and one advertiser from a advertising agency, one scriptwriter, one actor, one director, one producer, one academic and one television viewers. To be able to strengthen the experts' ideas, we benefited from the previous academic findings. The list of the supporting factors identified by the experts and the supporting literature can be seen in Table 5.1

Star Value of The Lead Role

Zuckerman et al. (2003), demonstrated that many film actors have become associated with particular genres of film/dramas , such as action adventures or westerns and even if these actors expand their repertoires, they find it difficult to convince audiences of their broader range (as cited in Waguespack & Sorenson, 2011). One another point is that a cast consists of famous, well-known actor/ actresses has a power to persuade to television channel when the contunity and the success of the first episode of the drama is considered since it would draw attention of the audiences' even in the first episode. (Deloitte, 2014). It is necessary to say that the most of the actors/actresses have a certain groups of fan, this fact also effects the success of the television drama.

The Quality of The Scenario

According to the latest research condcted by Deloitte (2014), scenario is one of the success factors of a television drama, although, star value effect of the actors/actresses has an importance to draw attention of the audiences' at first step, for the subsequent episodes, the importance of the scenario reveals and strong ones are able to survive.

The Genre

Another key determinant of viewing is the program type, often called "genre", where viewers might form preferences for program styles such as drama or comedy. Henry & Rinne (1984) pointed out that effect of the program genre for program ratings. Horen (1980) categorized the genres into four groups: light contents (soap opera, comedy etc) , heavy contents (news, documentary, drama etc.), sport and movies. When it comes to television dramas, it is possible to generate the same categorization. When the research done by Deloitte (2014), it can be observed that in Figure 6.1. the romantic dramas are the most preferred ones, comedies are following them. It can be easily referred that to get more audience the romantic types of dramas are more preferred by production companies and the television channels.

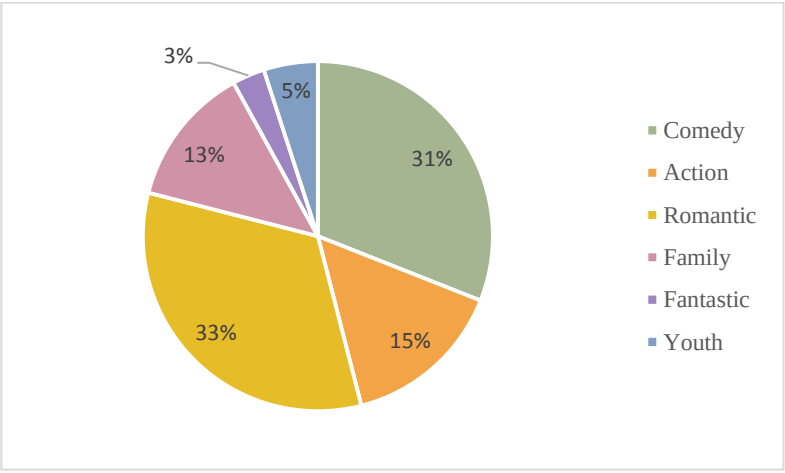

Figure 6.1. Common Genres of The Television Dramas in Turkey (Deloitte, 2014)

The Television Channel

Webster & Wakslag (1983) referred to the studies of previous researchers (Bruno, 1973; Darmon, 1976; Goodhart et al., 1975; Rao, 1975) and stated that "Channel loyalty", the tendency of programs on the same channel to have a disproportionately large duplicated audience, is a routinely observed feature of viewing behavior. Tavakoli & Cave (1996) stated that in their study , the probability of watching channel, depends on the characteristics of programmes on that channel and of programmes offered by competing channels (Darmon, 1976; Zufryden, 1973) stated that if all channels were showing the same programme, they would not share audiences in equal proportion because some channels have greater viewer loyalty that others (as cited in Tavakoli& Cave, 1996). The exprerts who share the thoughts for our study indicated that, even the consistency between the characteristic or theme of the channel and the audiences'political view , philosophy of life, also effects the channel preference and loyality. Moreover, Penpece & Yılmaz (2014) pointed out that the level of television dramas viewing and liking also provides the loyality to that channel.

Table 6.1. The Supporting Factors of Television Drama Industry and The Supporting Literature

Short Code	The Definition of the Concepts	Author(s)
C1	Star Value of The Lead Role	• Zuckerman E. W., Kim T.Y., Ukanwa K. and Rittmann J.V.(2003) • Deloitte (2014)
C2	The Quality of the Scenario	• Deloitte (2014)
C3	The Genre	• Horen J.H.(1980) • Henry M.D. and Rinne H.J.(1984) • Deloitte (2014)
C4	The Television Channel	• Zufryden F. S. (1973). • Darmon R.(1976). • Webster J.G. and Wakslag J.J.(1983) • Tavakoli M. and Cave M.(1996). • Penpece D. and Yılmaz E.(2014).
C5	Critics via Social Media	• Jansen B., Zhang M., Sobel K., and Chowdury A.(2009). • Wakamiya S., Lee R. and Sumiya K.(2011). • Maviş M. (2013)
C6	The Advertisement/Promotion/ Launch Effect	• Godes D.,Mayzlin D.(2004). • Romaniuk J. (2007). • Penpece D. and Yılmaz E.(2014).

C7	Time Zone of the Day	• Gensch, D. and Shaman, P. (1980). • Patelis A., Metaxiotis K.,Nikolopoulos K. and Assimakopoulos V.(2003). • Danaher P.J., Dagger T.S. and Smith M. S.(2011).
C8	The Seasonility	• Patelis A., Metaxiotis K.,Nikolopoulos K. and Assimakopoulos V.(2003). • Danaher P.J., Dagger T.S. and Smith M. S.(2011). • Danaher P. and Dagger T.(2012)
C9	Star Value of the Director	• Inferred from the brainstorming of experts
C10	Shooting Location	• Yağcı, S.C. (2011).
C11	Production Company	• Waguespack D.M.and Sorenson O. (2011). • Deloitte (2014)
C12	Technical Features	• Deloitte (2014)
C13	Budget	• Deloitte (2014)
C14	The Ratio of Viewing of The Television Drama	
C15	Long Working Hours	• Inferred from the brainstorming of experts

Critics via Social Media

Jansen et al (2009) have examined Twitter as a mechanism for word-of-mouth advertising, and considered articular brands and products while examining the structure of the postings and the change insentiments (as cited in Cheng et al, 2011). With the recent advances in social networking sites such as Facebook and Twitter, audiences share their updates in almost real time across such open spaces, often simply writing what they are currently watching and thus a new kind of interaction between the TV stations and general audiences occurs between the both sides (Wakamiya et al, 2011). Wakamiya et al (2011) estimated the public TV viewing rates by finding tweets relative to TV watching. According the research of the Nielsen, users mostly spend their time on social media when they are online (Maviş, 2013). In the United States, the creation and sharing the hashtag related to the broadcasted series started with The Fringe aired on FOX channel , this application has been carried on for several television dramas in Turkey as well, therefore the comments of the audiences and the viewing rates of the dramas can easily be observed (Maviş, 2013). Twitter developers stated that the considering the number and frequency of hashtag of the releated program can be used as a method to estimate the active viewers (Maviş,2013). The twitter users most tweets between 21:00-22:00 and the second time interval is 22:00-23:00 (Maviş,2013).

The Advertisement/Promotion/ Launch Effect

Godes and Mayzlin (2004) studied on word of mouth effect in a model of TV ratings. Romaniuk (2007) stated that the word of mouth effect is the most influencial tool for the audiences' television program choice. He claimed that the an unsatisfied audience transfers his/her negative thoughts to the two times more people than satisfied audience does. In their study, Penpece & Yılmaz (2014), proposed that word of mouth aeefet between family and friends has a highest effect for the launch of the television drama with the percentage of 86.5% ,

television fragments/ adverts follows it with the 55.2%, social share websites come after them with 45.6% etc.

Time Zone of The Day /Day of the week

The early evening hours (19:30-21:00) vary considerably in the daylight-darkness relationship, but the late evening hours, 21:30 to 23:00, are dark during almost the entire year. It seems reasonable to assume that during the daylight segment of the annual cycle, warmer weather prevails and is accompanied by more outdoor activity (Gensch & Shaman, 1980). Patelis et al (2003) stated that according to statistical surveys, during the first zone of the day (2:00-8:00am) the lower viewership in front of the television , second zone (8:00-13:00), there is a constant increase, in the third zone (13:00-18:00), while this increase continue until the prime time, in the prime time zone (20:00-23:30) is the one with the largest viewership percentage. Furthermore, the total viewing number varies considerably across prime time, with 8 pm having the highest total audience, and 10 pm the lowest (Danaher et al, 2011).

The Seasonility

Danaher et al (2011) indicated that the ratings are highly seasonal, peaks in the winter months and troughs in summer. Danaher& Dagger (2012) in their study proved the seasonility has a significant effect on the ratings by revealing higher Tv viewing in winter than in summer.According to Patelies et al (2003)
during the summer months the average viewership is 20-30%. While, the average viewership increases through the autumn months to reach the 30-50% during the winter months. In our study, when the television viewing pattern is observed in Table 1.5., the same tendecy can be seen.

The Star Value of the Director

After a brainstorming, our expert team decided to star value effect of the director must be taken into account. Because, a director who has alreay proven his/her success before has more power to convince the actor or actress whose star values are high as well to work. Overall , to reveal a high quality product, the first steps are completed and this situtaion reflects the negotiation process of the production compnaies with the channels and make the process easier for them.

Shooting Location

Undoubtedly, particularly, Istanbul is a special place for the television drama industry since it hosts numerous visual beauties. However,in recent years, due to the traffic issue and the high costs in Istanbul, the producers start to change their route to Ankara (Yağcı, 2011). On the other hand, the emotional relationship that audiences established towards to the neighborhood where the dramas are shot also effective to prefer viewing that content. One other view that, climate of the destination might also be affective to choice that area. South and West parts of Anatolian are more suitable to be able to shot the television drama or film since the temperature is relatively higher than other parts of the country.

The Production Company & Technical Features & Budget

Even in our FMCs, all these concepts are evealuated seperately, it would be suitable to explain the importance of them under same heading since they are strongly related to each other. Firstly, in the process of purchasing of a new project by a television channel, the previous success of the production company has a great influence in the negotiation procedure since the television channel can trust in the company eaiser. Most successful production companies have been prementioned. One another aspect of the choice of production company is related to financial power of the company. When the production company has a powerful financial background, to work with the high quality directors,

scriptwriters, actors/actress, shortly, to deal with all the costs which is neceassary to product a good content is easier (Deloitte, 2014). From this point of view we can link the topic to the budget and the quality of technical features. To sump up, when the enough capital is provided, it is possible to reveal good products which are rich in terms of technical features. One more point to be evaluated that there are some views that that the producers may also become identified with some particular category Waguespack & Sorenson (2011) as the film actors have become associated with particular genres of film/dramas even if these actors expand their repertoires, they find it difficult to convince audiences of their broader range the producers can suffer from the same perceptions.

Long Working Hours

After a brainstorming, our expert team decided to long working hours effect must be taken into account. It is a fact that, in recent years, incraesing costs of the televiison dramas, leads the channel owners to force production companies to extended the time of dramas. Thus, they can fit more number of advertising slots within a content and obtain more revenue. Inevitably, all the employees of a television drama from the actors/actresses, directors to the hundreds of employees behind camera have to work for long hours. After a certain length of time, the motivation, concentration and efficieny of all the employees and the quality of the programs also moves down.

After the identification of the supporting factors, experts evaluated their effects on each other and identified the direction of the interconnection with the terms of positive and negative or zero. Then, they evaluated the magnitude of the influence with the express as in Stylios & Groumpos (2004):

WHEN the value of concept Ci {**increases**, **decreases**,**is stable**}**THIS** causes value of concept Cj to {**increase**, **decrease**, **nothing**} **THUS** the influence of concept Ci on concept Cj is *T(influence)*

While determining the weights of the interconnections, they benefited from the T (infuence) set Table 3.1 which includes lingusitic variables and the corresponding membership values. End of this procedure a matrix whose dimension of 15x15 is obtained. (Table 6.2.)

Table 6.2. The Initial Matrix of Supporting Vectors (IMS) of the Television Drama Industry According to Expert 1.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
C1	z	pvs	pvs	pvs	ps	ps	pvs	pvs	z	z	z	ps	ps	ps	ps
C2	pvs	z	pvs	ps	ps	pm	pvs	pvs	pm	pm	z	ps	pw	ps	ps
C3	ps	pvs	0	ps	ps	ps	pvs	pvs	z	z	z	z	z	pm	ps
C4	pvs	pvs	ps	z	pm	ps	nvs	ps	ns	z	pm	ps	ps	pvs	nm
C5	ps	ps	pm	ps	z	pvs	pm	z	pvs	z	ps	pm	z	pm	pm
C6	pvs	pvs	pvs	ps	pvs	z	z	z	pvs	z	ps	ps	pm	ps	z
C7	pm	pm	pm	ps	pm	ps	z	z	z	z	z	z	z	pm	z
C8	pvs	pvs	ps	ps	ps	pm	ps	z	ns	z	z	z	z	pm	z
C9	pvs	pvs	pvs	pvs	ps	ps	ns	ns	z	z	ps	pvs	ps	pvs	z
C10	z	z	z	z	z	z	z	pm	z	z	z	z	pm	z	ps
C11	ps	pvs	ps	ps	pm	pm	pm	ps	ps	z	z	ps	pm	pm	pvs
C12	ps	pvs	pvs	ps	pm	pm	ps	ps	ps	z	ps	z	ps	ps	ps
C13	ps	pvs	ps	pvs	z	ps	z	z	pm	ps	pvs	pvs	z	pw	ns
C14	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z
C15	ps	pvs	ps	ps	z	z	z	ps	z	z	ps	ps	ps	z	z

6.2. Aggregation of the Supporting Factors and Obtaining AMS

After the completion of the initial matrix, since six experts have contributed to our study, six initial matrices have been obtained. Basically, six different thoughts have been acquired for each interconnections.

In this step, each weight identified with linguistic variables has been summed with the SUM method and produced the overall weight of each interconnection. To make it clearer, Figure 6.2,6.3,6.4 shows, particularly, three different weights which have been assigned by three different experts for a interconnection. The aggregation procedure has been applied as below.(Figure 6.5)

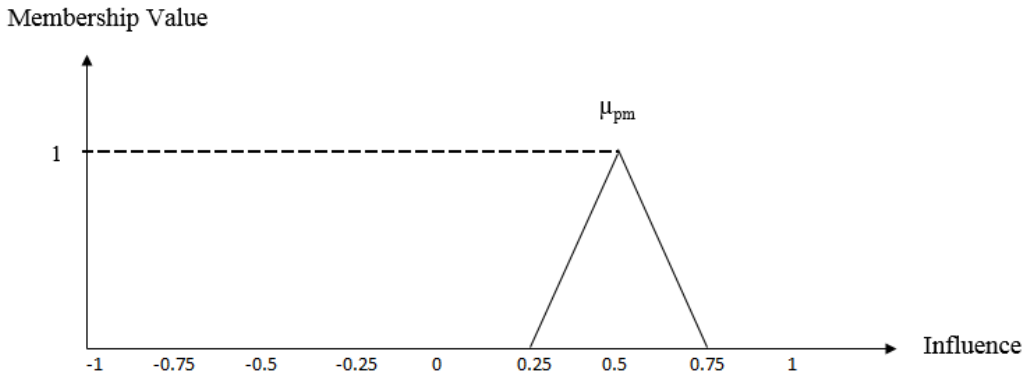

Figure 6.2. The Initial Weight Assigned by Expert 1

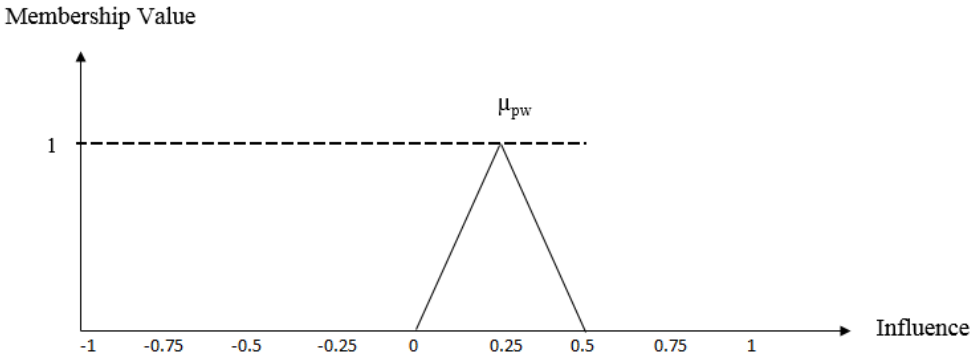

Figure 6.3. The Initial Weight Assigned by Expert 2

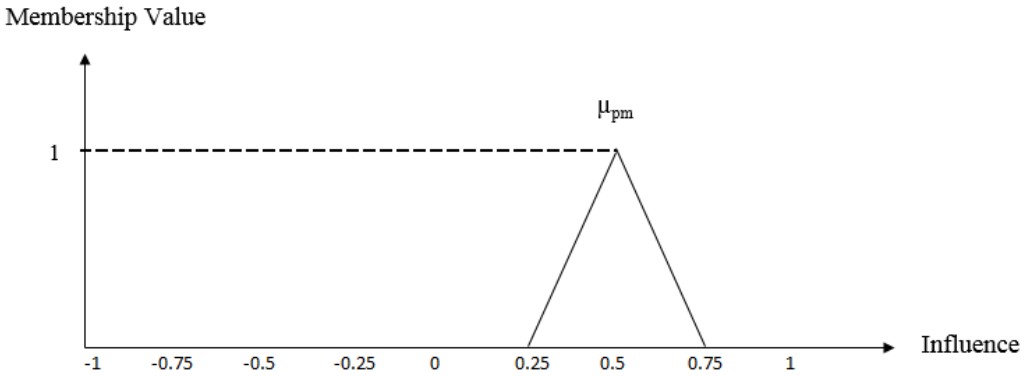

Figure 6.4. The Initial Weight Assisgned by Expert 3

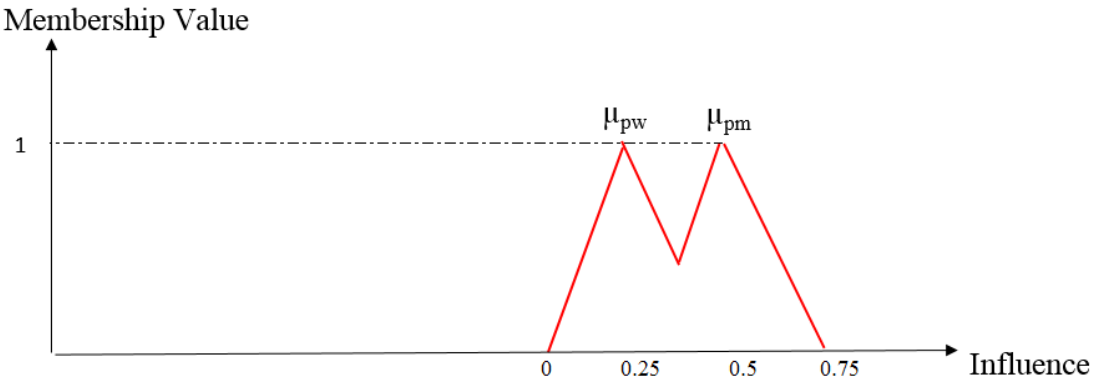

Figure 6.5. Aggregation of the Weights by Using SUM Method- PM-PW-PM

The same procedue is applied for six experts and the weights assigned by them, thus, the overall values between the interconnections are identified.

6.3. Weighting of the Supporting Factors and Obtaining WMS

In this step, AMS has been converted into the WMS which only contains numerical weights in the range [-1,1] by defuzzifying the linguistic weights between the interconnections. As explained before, Center of Gravity (CoG) Method has been applied for the defuzzification procedure.

$$wij = \frac{\int \mu i(x) x \, dx}{\int \mu i(x) dx} \qquad (1)$$

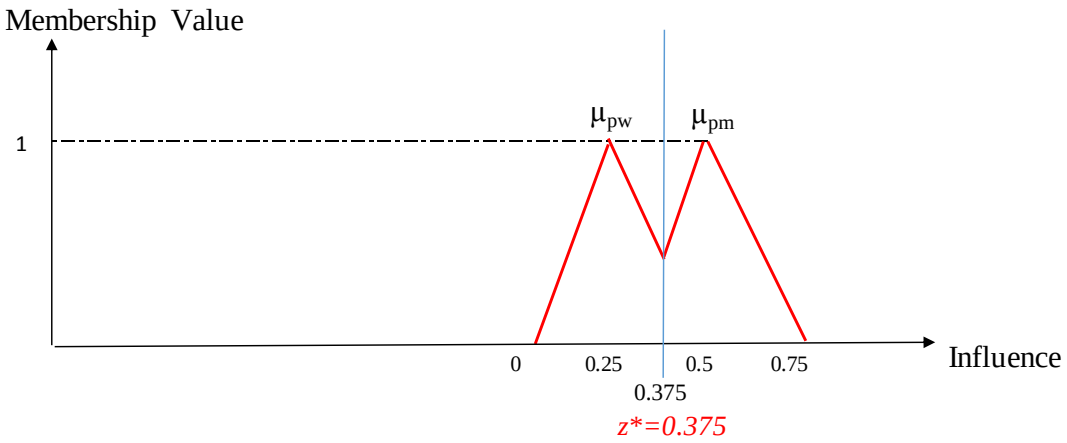

Figure 6.6. The Defuzzification Procedure of Aggregated Linguistic Variables by Using CoG

$$Z^* = \frac{\int_0^{0.25} \frac{z}{0.25} z dz + \int_{0.25}^{0.375} \frac{(0.5-z)}{0.25} z dz + \int_{0.375}^{0.5} \frac{(z-0.25)}{0.25} z dz + \int_{0.5}^{0.75} \frac{(0.75-z)}{0.25} z dz}{\int_0^{0.25} \frac{z}{0.25} dz + \int_{0.25}^{0.375} \frac{(0.5-z)}{0.25} dz + \int_{0.375}^{0.5} \frac{(z-0.5)}{0.25} dz + \int_{0.5}^{0.75} \frac{(0.75-z)}{0.25} dz} = 0.375$$

All the identified weights have been calculated with the similar fashion. The results have been obtained by coding the CoG formula on MATLAB. End of this step Weight Matrix of Supporting Factors has been obtained. (Table 6.3). The fuzzy cognitive map of the model has been drawn by using PAJEK software (Figure6.7) .

Table 6.3. Weight Matrix of Success Factors of The Television Dramas

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
C1	0,00	0,70	0,62	0,70	0,62	0,83	0,83	0,70	0,62	0,75	0,70	0,50	0,83	0,83	-0,25
C2	0,83	0,00	0,68	0,75	0,75	0,50	0,83	0,68	0,75	0,50	0,62	0,75	0,83	0,94	0,00
C3	0,70	0,83	0,00	0,50	0,62	0,50	0,83	0,94	0,62	0,75	0,75	0,75	0,83	0,83	0,75
C4	0,83	0,83	0,10	0,00	0,62	0,70	0,83	0,38	0,75	0,75	0,14	0,75	0,20	0,83	-0,02
C5	0,94	0,75	0,14	0,68	0,00	0,62	0,75	0,50	0,75	0,75	0,26	-0,25	0,00	0,83	0,25
C6	0,83	0,00	0,25	0,68	0,70	0,00	0,40	0,31	0,50	0,50	0,83	-0,25	0,24	0,70	0,00
C7	0,68	0,40	0,94	0,83	0,75	0,62	0,00	0,62	0,75	0,00	0,55	0,00	0,94	0,94	0,00
C8	0,68	0,83	0,68	0,62	-0,75	0,62	0,62	0,00	0,62	0,00	0,75	0,50	0,09	0,83	-0,75
C9	0,68	0,75	0,75	0,75	0,75	0,25	0,75	0,75	0,00	0,00	0,50	0,50	0,75	0,94	0,00
C10	0,00	0,62	0,75	0,50	0,75	0,50	0,25	0,00	0,00	0,00	0,50	0,60	0,00	0,50	-0,10
C11	0,83	0,62	0,75	0,75	0,75	0,83	0,94	0,50	0,50	0,50	0,00	0,00	0,70	0,94	0,00
C12	0,75	0,75	0,75	0,50	0,50	0,00	0,00	0,50	0,62	0,50	0,75	0,00	0,00	0,75	-0,94
C13	0,83	0,62	0,83	0,83	0,00	0,83	0,83	0,68	0,62	0,75	0,68	0,50	0,00	0,50	0,00
C14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C15	-0,50	0,75	0,00	0,83	0,00	0,00	0,00	0,00	0,00	0,50	0,83	0,94	-0,94	0,00	0,00

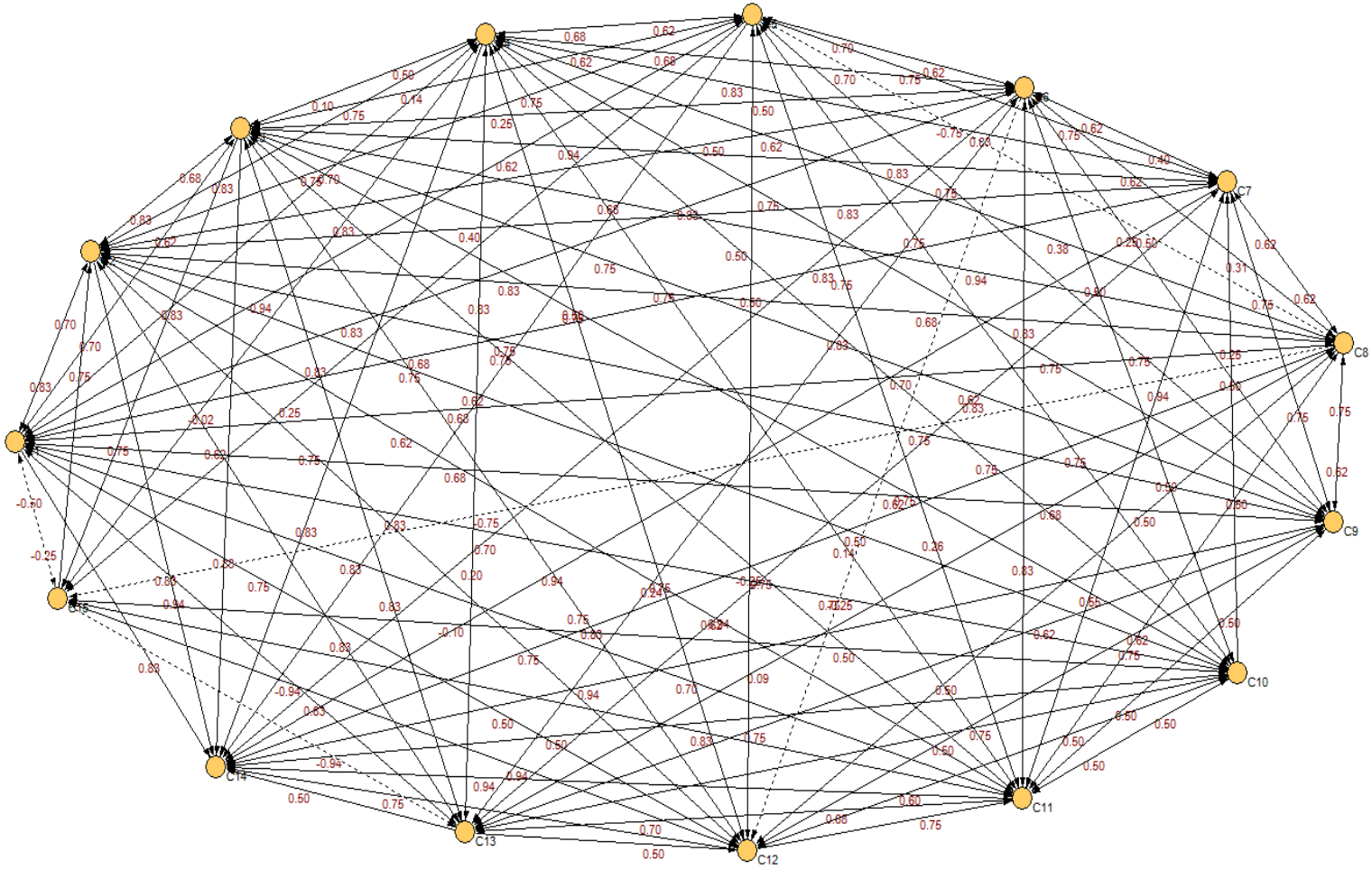

Figure 6.7. The Fuzzy Cognitive Map of The Success Factors of Television Dramas

7. SCENARIO ANALYSES AND THE DYNAMIC BEHAVIOR OF THE MODEL

As it can be understood from the structure of the map in Figure (6.7), all the success factors are interconnected each other. To be able to observe the behavior of the sytem in detail**,** it is necessary to develop "What If" questions. FCMapper Software program is quite appropriate for this sort of study. In our study, to develop various scenarios FCMapper has been used.

When the first results are tackled, the most outstanding result of the model is that while 14 of the success factors are ordinary variables, only one which represents *"The Ratio of Viewing The Television Drama* " is receiver varible. As it is known, there variables are: transmitter variables, receiver variables and ordinary variables (means) These variables are categorized according to their outdegree and indegree values. The transmitter variable has a positive outdegree value and the zero indegree. Basically, this variable can be defined that only affects the other concept but is not affected by any of them. In our model there is no such a success factor. In contrast, receiver variable has a positive indegree value and zero outdegree. This variable can be defined that is affected by all the other variables but does not affect any of them. In our model the concept of "*"The Ratio of Viewing The Television Drama*" is only receiver variable. The rest of the factors affect and are affected by each other which are ordinary ones. The contribution of a variable in a cognitive map can be understood by calculating its centrality, which shows how connected the variable is to other variables and what the cumulative strength of these connections are (Özesmi & Özesmi, 2004). The variables which have highest centralitiy can be ranked: *Star Value of the Lead Role, The Quality of The Scenario, Genre, Television Channel.*

7.1. First Scenario: Changing Star Value of The Lead Role

Table 7. 1. Changing Star Value of the Lead Role from 1 to 0.1 and 0.5

	Concepts	No Changes (Scene 1)	Scene 2	Scene 3	Results - No Changes (Scene 1)	Results - Scene 2	Results - Scene 3
C1	Star Value.Lead Role	1,00	0,10	0,50	1,00	0,10	0,5
C2	Scenario	1,00			0,999613	0,9992911	0,99945861
C3	Genre	1,00			0,9992731	0,9987145	0,99900342
C4	TV Chan.	1,00			0,9997467	0,9995375	0,99964632
C5	Social Share Cri.	1,00			0,9976278	0,9958434	0,99676174
C6	Advert/Launch	1,00			0,998858	0,9975729	0,99826545
C7	Time Zone	1,00			0,9996053	0,99916	0,99940011
C8	Seasonility	1,00			0,998577	0,9973122	0,99797534
C9	Star Value of Direc.	1,00			0,999156	0,9985114	0,99884409
C10	The Shooting Destin.	1,00			0,997174	0,9945336	0,99592423
C11	Production Company	1,00			0,999266	0,998660	0,998975
C12	Technical Features	1,00			0,989895	0,984821	0,987329
C13	Budget	1,00			0,994269	0,987443	0,991141
C14	The Ratio of Viewing	1,00			0,999968	0,999931	0,999951
C15	Long Working Hours	1,00			0,258198	0,304646	0,283366

Table 7. 2. The Results of the Changing Star Value From 1 to 0.1 and 0.5

Scenario 2				**Scenario 3**	87,5		
Positive Changes	strength (pos)	Negative Changes	strength (neg)	Positive Changes	strength (pos)	Negative Changes	strength (neg)
C15	1	C2	3	C15	1	C2	3
		C3	3			C3	3
		C4	3			C4	3
		C5	2			C5	3
		C6	2			C6	3
		C7	3			C7	3
		C8	2			C8	3
		C9	3			C9	3
		C10	2			C10	2
		C11	3			C11	3
		C12	2			C12	2
		C13	2			C13	2
		C14	4			C14	4

In the first scenario, the Activation Level (AL) of the “Star Value of the Lead Role” has been taken as 0,1 and 0,5. When the AL has been changed from 1 to 0,1, all other concepts have been influenced negatively, except “Long Working Hours”. From this point of view , it can be inferred that when the star value of lead role significantly decreases, working hours increase. On the other hand, when the AL changed from 0,1 to 0,5, social share critics for the drama and the effect of advertisement and launch display weak positive change. Another positive tendency can be observed in seasonility factor. When the value of the star increase, the broadcasting season of the drama is chosen as relatively high season like winter months. Overall, there is no considerable influence (very weak negatively) on the viewing ratio changing only star value of the lead role in both scenario .

7.2. Second Scenario: Changing Star Value of The Lead Role, The Quality Of The Scenario and The Television Channel

When only the star value of the lead role there is no significant effect in the viewing ratio of the drama:

Table 7.3. Changing Only Star Value of The Lead Role from 1 to 0.1 and 0.9

	Concepts	No Changes (Scene 1)	Scene 2	Scene 3	Results - No Changes (Scene 1)	Results - Scene 2	Results - Scene 3
C1	Star Value.Lead Role	1,00	0,10	0,90	1,00	0,10	0,9
C2	Scenario	1,00	0,10	0,10	0,999613	0,1	0,1
C3	Genre	1,00	0,10	0,10	0,9992731	0,1	0,1
C4	TV Chan.	1,00	0,10	0,10	0,9997467	0,1	0,1
C5	Social Share Cri.	1,00			0,9976278	0,9735257	0,98428225
C6	Advert/Launch	1,00			0,998858	0,9879206	0,99404107
C7	Time Zone	1,00			0,9996053	0,9915046	0,99581514
C8	Seasonility	1,00			0,998577	0,9819936	0,9901307
C9	Star Value of Direc.	1,00			0,999156	0,9887033	0,99348442
C10	The Shooting Destin.	1,00			0,997174	0,9624456	0,97972249
C11	Production Company	1,00			0,999266	0,993427	0,996386
C12	Technical Features	1,00			0,989895	0,881432	0,916771
C13	Budget	1,00			0,994269	0,941248	0,970170
C14	The Ratio of Viewing	1,00			0,999968	0,999151	0,999596
C15	Long Working Hours	1,00			0,258198	0,202436	0,166638

Table 7. 4. The Results of the Changing Only Star Value of The Lead Role from 1 to 0.1 and 0.9

	% of Variables Changed				% of Variables Changed		
Scenario2	68,75			Scenario3	68,75		
Positive Changes	strength (pos)	Negative Changes	strength (neg)	Positive Changes	strength (pos)	Negative Changes	strength (neg)
		C5	1			C5	1
		C6	1			C6	2
		C7	2			C7	2
		C8	1			C8	2
		C9	1			C9	2
		C10	1			C10	1
		C11	2			C11	2
		C12	1			C12	1
		C13	1			C13	1
		C14	3			C14	3
		C15	1			C15	1

When the star value of the lead role , the quality of the scenario and the the quality of the television channel has been changed equally the results as follow:

Table 7. 5. Changing The Quality of Scenario and Television Channel with The Star Value of Lead Role

Concepts	No Changes (Scene 1)	Scene 2	Scene 3	Results - No Changes (Scene 1)	Results - Scene 2	Results - Scene 3
Star Value.Lead Role	1,00	0,10	0,90	1,00	0,10	0,9
Scenario	1,00	0,10	0,90	0,999613	0,1	0,9
Genre	1,00	0,10	0,10	0,9992731	0,1	0,1
TV Chan.	1,00	0,10	0,90	0,9997467	0,1	0,9
Social Share Cri.	1,00			0,9976278	0,9735257	0,99490933
Advert/Launch	1,00			0,998858	0,9879206	0,99778243
Time Zone	1,00			0,9996053	0,9915046	0,99892231
Seasonility	1,00			0,998577	0,9819936	0,99597781
Star Value of Direc.	1,00			0,999156	0,9887033	0,99814709
The Shooting Destin.	1,00			0,997174	0,9624456	0,99278459
Production Company	1,00			0,999266	0,993427	0,998146
Technical Features	1,00			0,989895	0,881432	0,973594
Budget	1,00			0,994269	0,941248	0,986881
The Ratio of Viewing	1,00			0,999968	0,999151	0,999910
Long Working Hours	1,00			0,258198	0,202436	0,156383

When the second case is compared with the first one, it can be observed that there is weak positive increase in the viewing ratio of the television drama. Similary, an incrase occurs social media critics, time zone of the day (The increase in this concept can be considered the convergence to the prime time interval) and budget.

The changes on the success factors as follow:

Table 7. 6. The Resulf of Changing The Quality of Scenario, Television Channel and Star Value

	% of Variables Changed				**% of Variables Changed**		
Scnario 2	68,75			**Scnrio 3**	68,75		
Positiv Chng	strength (pos)	Ngtive Chn	strength (neg)	Positive Changes	strength (pos)	Negative Changes	strength (neg)
		C5	1			C5	2
		C6	1			C6	2
		C7	2			C7	3
		C8	1			C8	2
		C9	1			C9	2
		C10	1			C10	2
		C11	2			C11	2
		C12	1			C12	1
		C13	1			C13	2
		C14	3			C14	4
		C15	1			C15	1

8. CONCLUSION

The aim of this study is identifying and evaluating main success factors of television drama. Since FCM has the ability to deal with feedback process and study with many variables which may not-be well defined, limited, uncertain but can be expressed with the lingusitic degrees and to model the system in order to observe the dynamic behavior, the proposed model is well- suited for our subject.

We select 15 success factors (one of them is the output variable) that can affect the success of a television drama. The success factors have been compiled with the knowledge of the experts' in the industry. All the concepts have been evaluated according to their influence degrees on each other and a weighted supporting factors matrix has been obtained. To be able to observe the behavior of the system, FCMapper Software which allows to develop scenario analysis has been used.

According to the results, the most outstanding result of the model is that while 14 of the success factors are ordinary variables, only one which represents *"The Ratio of Viewing The Television Drama* " is receiver varible that is affected by all the other variables but does not affect any of them.. In our model there is no such a transmitter varaible. Basically, there is no variable that only affects the other concept but is not affected by any of them. The rest of the factors affect and are affected by each other which are ordinary ones

The variables which have highest centrality can be ranked: *Star Value of the Lead Role, The Quality of The Scenario, Genre, Television Channel,Production Company,Time Zone of The Day, The Star Value of The Director, Critics via Social Media.* This variables have highest contribution to the output of the system.

When the scenario analyses are examined, the most important outcome is that any of the concepts alone do not cause a considerable change in the viewing ratio of the television drama. However, when the value of a concept change with the other interconnected concepts at the same time, noticeable changes occur in the viewing ratio. In the second scenario, when the quality of the scenario and the television channel are increased along with the star value of the lead role, positive changes occured in viewing ratio of the television drama ,social media critics, time zone of the day (The increase in this concept can be considered the convergence to the prime time interval) and budget. It can be interpreted that when the drama switch to a channel which have high viewer loyality,and start working with more famous actors/actress, this changes make this production a promising investment. From this point of view our model can be used as a decision making tool.

In our model, there are some shortcomings that are sourced from the nature of the FCM. The model is open up to the experts' ignorances, biases. They can also miss the details.To deal with this issue, the model can be built on more experts' knowledge. Thus the level of represantion of the model can be promoted. Also, for further research, prediction models can be developed by using Neural Network. This explanatory technique can be combined with the traditional linear techniques.

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