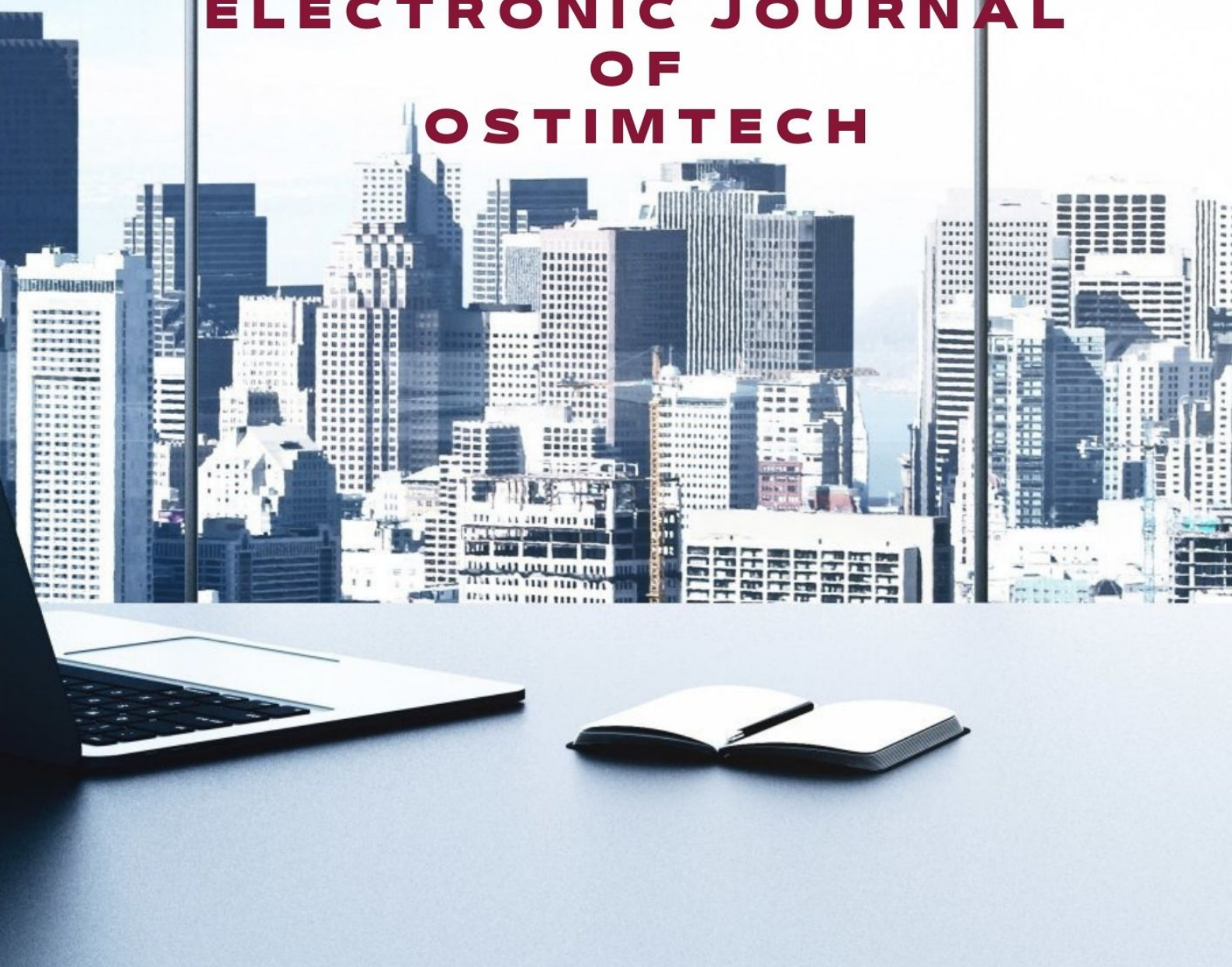
VOLUME :1
ISSUE:1
YEAR:2022

ISSN NO:

OSTİM TECHNICAL UNIVERSITY

EJOSTIMTECH

INTERNATIONAL ELECTRONIC JOURNAL OF OSTIMTECH



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2022

EJOSTIMTECH INTERNATIONAL ELECTRONIC JOURNAL OF OSTIMTECH

2022, VOLUME:1, ISSUE:1

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OSTIMTECH

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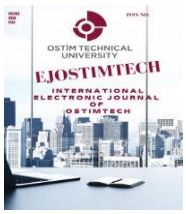

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EJOSTIMTECH International Electronic Journal of OSTIMTECH

EJOSTIMTECH, 2022; 1(1):6-17

SUSTAINABLE CONSUMPTION BEHAVIORS OF YOUNG CONSUMERS: A STUDY FROM THE PERSPECTIVE OF CONSUMER ENGAGEMENT

Seray Kağıtçı[1]

Abstract

The rapid increase in production activities, technological developments, and globalization have led to a change in consumption habits and an increase in the desire for faster and more consumption. This change in consumption processes has rapidly depleted limited resources and brought them to the point of extinction. Faced with this situation, threatening the lives of current and future generations, the concept of sustainability, which has been on the agenda for the last 30 years, has come to the fore. Thus, concepts such as sustainable development, sustainable life, and sustainable consumption have become important. The development goals published by the United Nations include achieving green growth in the context of sustainable consumption by 2030. In this context, it is important to support and encourage sustainable consumption. It is essential to encourage the participation of the younger generation, who grew up in a society of overconsumption, in sustainable consumption. The literature shows that the concept of consumer engagement is a strategic and important tool for encouraging consumers to perform certain consumption behaviors. However, in studies on sustainable consumption behavior, little attention has been given to the subject of consumer engagement. This study aimed to reveal the sustainable consumption behaviors of young consumers through consumer engagement. In this context, the intermediary role of consumer engagement in the impact of environmental attitude and perceived environmental responsibility on sustainable consumption behavior has been examined. Therefore, quantitative research was carried out by choosing the questionnaire technique and the 134 analyzable data obtained were tested with the Structural Equation Model using AMOS v21. The results show that young consumers' perceived responsibility and environmental attitudes have a statistically significant and positive influence on their sustainable purchasing behavior. Also, the results indicate that consumer engagement plays a partially mediating role in the relationship between environmental attitudes, perceived environmental responsibility, and sustainable consumption behavior.

Keywords: Sustainable Consumption, Consumer Engagement, Young Consumers

Introduction

Globalization, technological development, and the rapid increase of the world population lead to rapid consumption of resources in industrial and individual consumption areas. Modern society simultaneously carries overconsumption, which expresses the desire to consume more, and the concern about the negative effects of resource use on the environment. Overconsumption creates negative ecological effects and disturbs the natural balance by bringing natural resources to the brink of extinction (Shirsavar & Fashkhamy, 2013). However, although environmental concerns are increasing, sustainable consumer behavior has not risen sufficiently.

Policies developed to reduce environmental problems and protect the ecological balance so that present and future generations can continue their lives in prosperity have brought the concepts of sustainability and sustainable consumption to the forefront in all areas. Sustainable consumption is a form of consumption based on the use of the existing resources of the world within limits, trying to find solutions that reduce all kinds of negative impacts on the environment (Roy et al. 2015). According to another definition, sustainable consumption is the individual actions of consumers in the process of acquiring, using, and disposing of goods, products, and services, taking into account their impact on ecological and socioeconomic conditions for present and future generations (Geiger et al. 2018). Studies

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conducted by various international organizations and scientists show that conscious and sensitive consumers toward the concept of sustainability play a positive role in alleviating environmental problems (Mont et al. 2014; Geiger et al. 2018). Most research on sustainable consumption has examined the factors that determine ecologically conscious consumption behaviors of consumers (Pepper et al. 2009; Wang et al. 2014; Biswas & Roy, 2015; Wu et al. 2016). Understanding which factors influence sustainable consumption is considered important as it will show what kind of marketing strategies and tools will be used to make consumer behavior more environmentally aware. Since it is understood that the negative effects of unsustainable consumption behaviors cannot be addressed by one-way communication, numerous studies have been conducted on tools and methods to engage consumers in a two-way and active dialogue (Huber & Hilty, 2015; Mattila et al. 2016). Accordingly, governments, businesses, international institutions and organizations, non-governmental organizations, and consumers should adopt and participate in sustainable consumption behaviors which stand out within the scope of combating environmental problems.

The literature shows that consumer engagement is an important and strategic tool in promoting some consumer behaviors (Hollebeek, 2011; Thakur, 2016; Hollebeek et al. 2016). However, a limited number of empirical studies have been conducted that integrate consumer engagement in the context of sustainable consumption, which occupies an important place on the global agenda. To properly understand the sustainable consumption behaviors of consumers, it is important to determine how consumer engagement changes these behaviors. In addition, it is considered important to examine sustainable consumption behaviors through young consumers, who are future decision-makers. According to Caruana & Rosella (2003), young consumers are a potential force for environmental protection because they have a significant environmental awareness. It is a critical process to include young consumers, especially those who are growing up in the consumption society, in this process in order to promote sustainable consumption. The purpose of this study was to demonstrate the impact of perceived responsibility and environmental attitudes of young consumers on sustainable purchasing behavior through consumer engagement within the context of sustainable consumption behaviors.

Conceptual Framework and Research Hypothesis

Sustainable Consumption

The concept of sustainable consumption refers to the use of goods and services that are economically viable, socially fair, and have a minimal harmful impact on the environment to meet the basic needs of people all over the world. Although sustainable consumption has been on the agenda since 1990, there is still a big difference between people's demands and their buying behavior (Lim, 2017).

The definition of the concept of sustainable consumption is quite complex, as it encompasses both the concept of sustainability and consumption at the same time (Durif et al. 2010). In many definitions, the satisfaction of consumer needs and the protection of the environment are considered as one (Gupta & Agraval, 2017). When sustainable consumption is examined as a term in the literature, it is seen that terms such as "green consumption", "ethical consumption", and "environmentally friendly consumption" is also used as alternatives to sustainable consumption (Peattie, 2010; Adams & Raisborough, 2010; Green & Peloza, 2014).

In 1995, the United Nations Environment Program defined sustainable consumption as consumption that does not compromise the needs of future generations by minimizing the use of natural resources and toxic substances, emissions and pollutants, while using products that meet basic needs and enhance the quality of life (Jones et al. 2011). However, this definition focuses on a single element of sustainable consumption, namely the ecological aspect. Sustainable consumption proposes a form of consumption based on the integration of economic, social and environmental aspects (Balderjahn et al. 2013). In other words, the concept of sustainable consumption also concerned with ecological and social issues such as environmental protection, quality of life and intergenerational equity. However, studies on sustainable consumption focus on one of these three elements, according to the field of study. Since the attitudes and values of consumers are examined in studies on consumer behavior and sustainable consumption, the environment is considered the most important element.

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In terms of sustainable consumption, consumers should include social responsibility toward the environment in the decision-making process in the purchasing process. The important thing here is to convince all consumers (Barber & Deale, 2014). Accordingly, sustainable consumption is a form of consumption aimed at understanding the answers and solutions to ecological environmental problems (Dolan, 2002). When making a decision to purchase a good or service, consumers consider not only consider price, performance and satisfaction. In addition, the consumer's own health and social sensitivity are also included in this process. As consumers gain this sensitivity, they have begun to consider the behavior of purchasing goods and services to meet their own needs without harming the natural balance (Barber & Taylor, 2013). Such purchasing behavior is the basis for sustainable consumption. Consumers who adopt sustainable consumption behavior prefer vehicles that consume less energy and resources, as well as products that are recyclable and less harmful to the environment (Alnıaçık, 2010). In the context of sustainable consumption with a broader perspective, preference is given to ecological, local, fair trade-based and durable products that do not harm the environment (Gilg et al. 2005). Sustainable consumption behavior is realized with environmental awareness.

The scope of sustainable consumption is listed by Hansen & Schrader (1997) as follows:

- Trying to reduce consumption
- Avoiding consumption as much as possible
- Making an effort to consume ecological products
- Considering the ecological nature of the products to be consumed

Sustainable consumption takes place in parallel with social responsibility (Wilhite & Lutzenhiser 1999). Because consumers who are aware of their social responsibility towards the environment engage in sustainable consumption behavior in order to protect their own lives and the lives of all other living beings.

Consumer Engagement

The concept of consumer engagement was introduced to the literature by the study by Brodie et al. (2011). In that study Brodie et al. (2011) defined consumer engagement as a psychological state of mind that includes cognitive, emotional, and behavioral aspects (Brodie et al. 2013; Dessart et al. 2015; Hollebeek et al. 2014). In this context, consumer engagement is a psychological state that results from interactive, co-creative customer experiences with an object.

Whereby the term consumer engagement is used in many different fields of science, it is considered very difficult to find a comprehensive definition for it. Javornik & Mandelli (2013) stated that consumer engagement can be based on the following approaches: Behavioral, psychological (cognitive and emotional), multidimensional and social. Since the multidimensional approach emphasizes the integration of the cognitive and emotional aspects of the consumer, it is considered to be the most studied approach to consumer engagement in recent years. In consumer engagement in marketing, researchers stated that the dimensions of consumer engagement can be single or multidimensional, depending on the research structure, and the number of dimensions changes accordingly (Brodie et al. 2011; Hollebeek, 2011; Hollebeek et al. 2014). Therefore, there is no agreed-upon model for the multidimensional consumer engagement approach. However, the most used model includes cognitive, emotional, and behavioral engagement (Hollebeek et al. 2014).

Brodie et al (2011) point out that engagement is an interactive behavior that is defined as a transitional state that occurs with the development of related engagement processes over a period of time. The definition of consumer engagement is generally based on the level of cognitive, emotional and behavioral relationships of consumers with an organization, product, brand etc. However, the interpretation of the term usually depends on the object of the engagement (company, product, brand, advertising, persuasion, etc.). In other words, engagement reflects an interactive relationship of the consumer to a particular content-specific object (Rather, 2019; Mostafa, 2021).

Consumer engagement stands out as a concept that explains the psychology of consumption behavior. In the literature, there are studies showing that consumer engagement affects consumption

behavior (Vivek et al. 2014; Bly et al. 2015; Miao & Wei, 2016). However, there are studies that try to explain sustainable consumption behavior with consumer engagement and come to positive results (Banyte et al. 2014; Piligrimiene et al, 2020). Based on these studies, the following hypothesis has been proposed:

H1: *Consumer engagements of young consumers have a positive effect on their sustainable consumption behavior.*

Environmental Attitude

Attitude can be considered as an individual's positive or negative reaction to a particular object or phenomenon (Khan & Kirmani, 2015). Similarly, environmental attitudes are positive or negative evaluations of the environment and form the basis of pro-environmental behavior (Nagar, 2015; Uddin & Khan, 2016). Environmental attitudes indicate individuals' perceptions of being a part of the environment. Individuals' positive attitudes towards the environment influence their choices in purchasing behavior (Zsoka et al. 2013; Nguyen et al. 2017).

In studies on sustainable consumption, it has been seen that environmental attitudes are behind consumers' purchasing behavior toward environmentally friendly green products or sustainable products (Akehurst, 2012; Zhao et al, 2014; Uddin & Khan, 2016). However, Kaiser et al (2007) and Uddin & Khan (2018) argued that environmental attitudes are an important antecedent in the sustainable consumption behavior of young consumers. Based on the studies in the literature, the following hypothesis was established:

H2: *Environmental attitudes of young consumers have a positive effect on their sustainable consumption behavior.*

A positive environmental attitude is an important element for sustainable consumption behavior. Kollmuss & Agyeman (2002), Janmaimool & Denpaiboon (2016), and Piligrimiene et al. (2020) stated in their studies that environmental attitudes are among the internal factors that determine the engagement of consumers in their pro-environmental behaviors. It is thought that a part of consumers' engagement towards sustainable consumption will consist of environmental attitudes (Cicala et al. 2016). Because environmental attitudes are assumed to affect the cognitive, emotional, and behavioral dimensions of engagement, the following hypothesis has been developed:

H3: *Consumer engagement has a mediating effect on the impact of young consumers' environmental attitudes on sustainable consumption behaviors.*

Perceived Environmental Responsibility

The responsibility that consumers feel toward the environment is extremely important in terms of sustainable consumption behaviors (Catlin et al. 2017; Capiene et al. 2021). In the study conducted by Milfont & Sibley's (2012), in which they investigated the factors affecting environmentally friendly behaviors, it was found that responsible individuals are more likely to adopt sustainable consumption. Based on these findings, the following hypothesis was formed:

H4: *Perceived environmental responsibilities of young consumers have a positive effect on their sustainable consumption behavior.*

Capiene et al. (2021) showed in their study that perceived environmental responsibility is one of the internal factors in engagement with sustainable consumption. Kollmuss & Agyeman (2002) and Piligrimiene et al (2020) stated in their studies that environmental responsibility is among the internal factors that determine the engagement of consumers in their pro-environmental behavior. Consequently, the following hypothesis has been proposed:

H5: *Consumer engagement has a mediating effect on the impact of young consumers' perceived environmental responsibilities on their sustainable consumption behavior.*

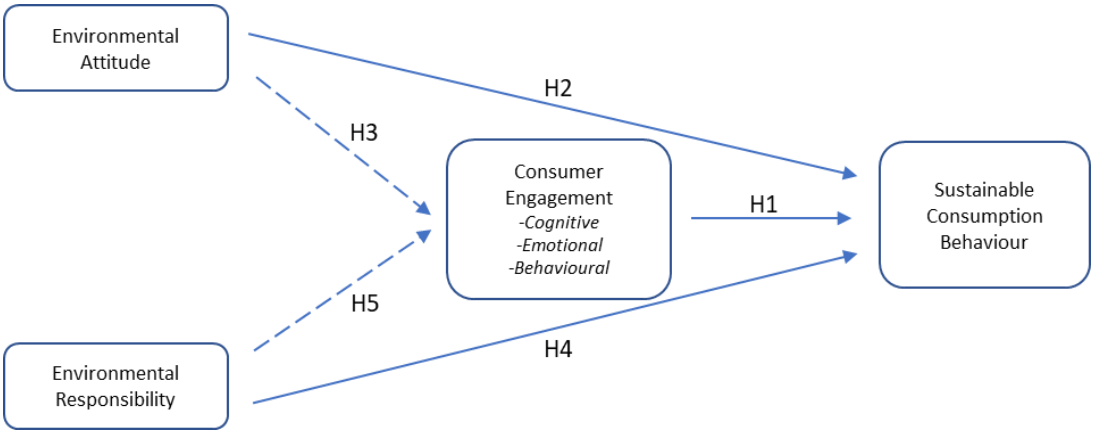

Figure 1. Research Model

Methodology

Data Collection

Questionnaire technique was used as the data collection method in the study. In order to reach young consumers in accordance with the research objective, the sample was formed by university students. Within the scope of the research, analyzable data were collected from 134 young consumers. The scales used in the study were adapted from the study by Piligrimene et al. (2020). Data were collected as online using Google Forms between April 15 and May 10, 2022. The data obtained from the questionnaires were first tested for validity and reliability using the SPSS 21 program and then analyzed for confirmatory factor analysis and discriminant validity using AMOS 21.

Analysis

In order to reveal the validity and reliability of the scales used in the research; factor analysis, Cronbach's Alpha test and confirmatory factor analysis were performed. In terms of testing the research hypotheses, the hypotheses were examined with the structural equation model using AMOS 21. Demographic information regarding the collected data is shown in Table 1.

Table 1. Demographic Data

Gender	N	%
Female	66	49,3
Male	61	45,5
Don't want to specify.	7	5,2
Total	134	100
Age	**N**	**%**
15-17	3	2,2
18-20	64	47,8
21-23	67	50,0
Total	134	100
Income	**N**	**%**
Less than 3000 TL	65	48,5
3001 TL - 4000 TL	37	27,6
4001 TL - 5000 TL	18	13,4
5001 TL - 6000 TL	8	6,0
More than 6001 TL	6	4,5
Total	134	100

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As shown in Table 1, 49.3% of the participants in the study were female and 45.5% were male. 50% of the participants are between 21 and 23 years old, 47.8% are between 18 and 20 years old and only 2.2% are between 15 and 17 years old. The monthly income of 48.5% of the participants is below 3000 TL. The reliability coefficients, factor loadings, and Kaiser-Meyer-Olkin (KMO) values of the scales used in the study are shown in Table 2.

Table 2. Factor Loads, KMO and Cronbach's Alpha Values

	Factor Loads	KMO	Cronbach alpha
Environmental Attitude		0,840	0,941
EA1	0,835		
EA2	0,821		
EA3	0,708		
EA4	0,784		
Perceived Environmental Responsibility		0,804	0,923
PER1	0,750		
PER2	0,824		
PER3	0,782		
PER4	0,727		
Consumer Engagement		0,876	0,938
Cognitive		0,789	
COG1	0,742		
COG2	0,758		
COG3	0,720		
COG4	0,712		
Emotional		0,846	
EMO1	0,807		
EMO2	0,687		
EMO3	0,825		
EMO4	0,766		
Behavioural		0,821	
BEH1	0,616		
BEH2	0,854		
BEH3	0,662		
BEH4	0,728		
Sustainable Consumption Behaviour		0,898	0,918
SCB1	0,804		
SCB2	0,822		
SCB3	0,853		
SCB4	0,776		
SCB5	0,849		
SCB6	0,793		

Looking at the Cronbach's Alpha coefficients for the variables used in the study in Table 2, it is seen that the values range from 0.918 to 0.941. Therefore, the scale items of the variables that make up the study are highly reliable (Cronbach, 1951). As a result of Kayser-Meyen-Olkin (KMO) and Barlett's tests to the data obtained during the study revealed that the KMO values were above .50 and the Barlett's tests were found to be statistically significant. The scale items related to the variables were loaded on the relevant factors, and it was observed that the factor loadings reached values between 0.662 and 0.854. The results of the confirmatory factor analysis, which was conducted to examine the validity of the scales in more detail, are shown in Table 3.

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Table 3. Confirmatory Factor Analysis Results

			B1	B2	S.E.	C.R.	P
EA4	<---	Environmental Attitude	0,942	1			
EA3	<---	Environmental Attitude	0,872	0,975	0,062	15,65	***
EA2	<---	Environmental Attitude	0,811	0,812	0,061	13,277	***
EA1	<---	Environmental Attitude	0,79	0,811	0,065	12,557	***
PER4	<---	Percd. Env. Responsibility	0,93	1			
PER3	<---	Percd. Env. Responsibility	0,831	0,792	0,057	13,812	***
PER2	<---	Percd. Env. Responsibility	0,807	0,856	0,066	12,983	***
PER1	<---	Percd. Env. Responsibility	0,851	1,016	0,07	14,549	***
BEH4	<---	Behavioural CE	0,867	1			
BEH3	<---	Behavioural CE	0,837	1,069	0,087	12,3	***
BEH2	<---	Behavioural CE	0,726	0,819	0,082	10,021	***
BEH1	<---	Behavioural CE	0,866	1,089	0,084	13,023	***
COG1	<---	Cognitive CE	0,926	1			
COG2	<---	Cognitive CE	0,943	0,872	0,046	19,116	***
COG3	<---	Cognitive CE	0,89	0,96	0,06	15,913	***
COG4	<---	Cognitive CE	0,702	0,713	0,07	10,17	***
EMO4	<---	Emotional CE	0,874	1			
EMO3	<---	Emotional CE	0,933	1,047	0,067	15,691	***
EMO2	<---	Emotional CE	0,86	1,05	0,08	13,139	***
EMO1	<---	Emotional CE	0,87	0,967	0,068	14,165	***
SCB1	<---	Sust. Consump. Behaviour	0,92	1			
SCB2	<---	Sust. Consump. Behaviour	0,958	1,015	0,048	21,354	***
SCB3	<---	Sust. Consump. Behaviour	0,913	1,04	0,056	18,512	***
SCB4	<---	Sust. Consump. Behaviour	0,833	0,881	0,062	14,299	***
SCB5	<---	Sust. Consump. Behaviour	0,805	0,872	0,066	13,242	***
SCB6	<---	Sust. Consump. Behaviour	0,849	0,902	0,06	14,944	***

**** p < 0.001*

The results of the confirmatory factor analysis for the scales used in the study are shown in Table 3. Accordingly, all scale items in the scale dimensions proved to be statistically significant (p<0,005). The standardized path coefficients (β1) for each scale item were also above 0.50. Confirmatory factor analysis (CFA) was performed using a maximum likelihood method (MLM) with a five-factor measurement model. The results of the CFA confirmed the validity of the empirically examined constructs. Composite Reliability (CR) and Average Variance Extracted (AVE) values were checked by using AMOS v.21 program in order to ensure convergence and discriminant validity within the scope of confirmatory factor analysis. Achieving convergent validity depends on CR values above 0.70 and AVE values above 0.50. The results of the master validity of the research model are shown in Table 4.

Table 4. Reliability, Convergent and Discriminant Validity Results

	CR	AVE	MSV	MaxR (H)	1	2	3	4	5	6
Environmental Attitude	0,916	0,732	0,571	0,936	0,856					
Percd. Env. Responsibility	0,916	0,733	0,571	0,929	0,755***	0,856				
Behavioural CE	0,895	0,682	0,547	0,905	0,531***	0,481***	0,826			
Cognitive CE	0,925	0,758	0,589	0,95	0,680***	0,588***	0,740***	0,871		
Emotional CE	0,935	0,783	0,455	0,941	0,661***	0,644***	0,675***	0,647***	0,885	
Sust. Consump. B.	0,954	0,777	0,589	0,966	0,596***	0,550***	0,720***	0,768***	0,612***	0,881

** p < 0.050, ** p < 0.010, *** p < 0.001*

Findings

The hypotheses of the study were analyzed with the structural equation model (SEM) using AMOS v.21. SEM is often used to test the proposed model and hypothetical relationships between observed and latent variables (Hoyle, 1995). According to the structural equation model results, the direct effect results are shown in Table 5 and the mediator effect results are shown in Table 6.

Table 5. Direct Effect Results

			Std. C.	Unstd. C.	S.E.	C.R.	P
Sust. Consump. Behaviour	<---	Environmental Attitude	0,273	0,312	0,107	2,903	0,004
Sust. Consump. Behaviour	<---	Percd. Env. Responsibility	0,283	0,322	0,107	3,012	0,003
Sust. Consump. Behaviour	<---	Consumer Engagement	0,706	0,815	0,071	11,483	0,000

According to the results of SEM carried out within the scope of the hypothesis test, consumer engagement has a positive and statistically significant effect on sustainable consumption behavior. Thus, H1 is supported (β=0,706, p<0,00). Environmental attitude has a positive and statistically significant effect on sustainable consumption behavior. SEM results also supported H2 (β=0,273, p<0,00). The results also supported H4, which argues that perceived environmental responsibility positively affects sustainable consumption behavior (β=0,283, p<0,00).

Table 6. Indirect Effect Results

			Std. C.	Unstd. C.	S.E.	C.R.	P
Consumer Engagement	<---	Environmental Attitude	0,281	0,276	0,083	3,332	0,000
Consumer Engagement	<---	Percd. Env. Responsibility	0,422	0,417	0,083	5,019	0,000
Sust. Consump. Behaviour	<---	Environmental Attitude	0,193	0,186	0,084	4,512	0,000
Sust. Consump. Behaviour	<---	Percd. Env. Responsibility	0,243	0,308	0,815	5,072	0,000

Mediator effect tested in the context of complete and partial mediation effect (James et al. 2006). According to the results of SEM for the indirect effect, the effect coefficient of environmental attitude and perceived environmental responsibility on sustainable consumption behavior changed when the variable of consumer engagement was included as a mediator in the model. Therefore, H3 and H5 were supported by a partial mediation effect.

Results and Discussion

Today, consumers' perceptions of the concepts of need and desire have changed due to reasons such as technological developments, globalization and diversity, and this has led to an increase in the desire to consume faster and more. Due to the desire to consume faster and more, limited resources are rapidly depleted, and therefore, the basic needs of today and future generations cannot be met. The existence of such a threat has set in motion the sustainability process, such as sustainable living and sustainable consumption, which began with the concept of sustainable development in the 1980s.

Sustainable consumption is the realization of processes of acquisition, use and disposal of goods, products, and services by consumers, taking into account all possible impacts for present and future generations. The policies regarding sustainability developed by international institutions and organizations and various organizations cannot be realized at the level expected to be accepted by consumers. The need to engage in active dialogue with consumers on environmental issues and to promote sustainable consumption behavior is evident in recent scientific discourse. In this context, one of the areas of great interest in the academic literature is the implementation of the consumer engagement structure, which is used to encourage consumer behavior. This study examined the effects of environmental attitudes and perceived environmental responsibility on young consumers' sustainable consumption behaviors and the mediating role of consumer engagement in these relationships. Thus, a

contribution was made to the implementation of consumer engagement in the field of sustainable consumption and to the sustainable consumption behaviors of young consumers.

As a result of the structural equation model, it was concluded that environmental attitude and perceived environmental responsibility have an effect on the sustainable consumption behaviors of young consumers. Accordingly, young consumers exhibit sustainable consumption behavior when their attitudes towards the environment improve. This finding is consistent with previous work by Kaiser et al. (2007), Zhao et al. (2014) and Uddin & Khan (2016). It was also revealed in the study that young consumers with a high level of perceived environmental responsibility exhibit sustainable consumption behavior. This finding confirms the study of Wang et al. (2014) and Milfont & Sibley (2012). Another issue investigated in the study is the evaluation of consumer engagement within the scope of sustainable consumption. In this context, the mediating role of consumer engagement between young consumers' sustainable consumption behavior, their environmental attitudes, and their perceived environmental responsibility has been investigated. The results indicate that consumer engagement plays a partially mediating role in the relationship between environmental attitudes, perceived environmental responsibility, and sustainable consumption behavior. Within the scope of the findings, a similar conclusion was reached with the study of Piligrimiene et al (2020).

Given the study's findings, governments and businesses should work to make sustainable products more accessible to consumers in terms of price and distribution to increase sustainable consumption. Advertising campaigns should also be designed by considering environmental effects and direct consumers towards sustainable consumption. These campaigns should take place on social media platforms where young consumers spend a lot of time. Improvement activities in environmental attitudes and understanding of environmental responsibility can be implemented through various gamifications and online communities. Thus, the cognitive, emotional and behavioral engagement of young consumers in sustainable consumption behaviors will be encouraged.

In this study, the research model was applied to young consumers. Different results may be obtained when it is applied to consumers of different ages or to different groups of consumers. The research is limited to the fact that it was carried out in Turkey in a geographical sense. It may differ considering different cultures. In this sense, a cross-cultural comparative study can be carried out. In addition, there are several factors in the literature that influence consumers' sustainable consumption behavior. The mediation effect of these factors on consumer engagement can be examined.

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OSTİM TECHNICAL UNIVERSITY

EJOSTIMTECH International Electronic Journal of OSTIMTECH

EJOSTIMTECH, 2022; 1(1):18-29

A RESEARCH IN TURKISH CULTURE ON THE REFLECTIONS OF KUT-BASED TASK CONCEPT TO ORGANIZATIONAL CITIZENSHIP BEHAVIOUR IN COMPARISON WITH WESTERN CULTURE

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Abstract

In Turkish thought, 'kut' (political power) is given to Kagan by God. The ruler is the ruler because God has given him 'kut' and the political power has the right to authority. The study is based on the idea that 'kut' provides a reference frame that 'duty' is sacred. This idea is based on both paradigms emic and ethics. In order to show the difference of duty's sacredness owing to kut between western and Turkish culture, Organizational Citizenship Behavior is used as a tool of test. The study is based on the assumption that the mean values obtained in empirical studies on Organizational Citizenship Behavior in Turkish Culture are higher than western cultures. The t-test results show that there is a significant difference ($t(53,81)=4,307$; $p<0,05$) between the studies of Organizational Citizenship Behavior in Turkish Culture and Western Culture. The average of Organizational Citizenship Behavior studies examined in Turkish Culture was found higher than average of Organizational Citizenship Behavior studies examined in Western Culture.

Keywords: Cross Culture, Culture, Emic, Ethic, Organizational Citizenship Behavior

Introduction

Today, there is strong evidence that the understanding of management is influenced by culture and the culture of the society affects the sense of management. As the extension of societies, the cultures of organizations, which are the most basic elements of modern working life, are also influenced by the dominant culture in the society to which the organization belongs.

It is important to know the cultural elements that affect the formation of organizational culture through indirect impact and to understand the dominant structure of that culture. Organizations operating in the Turkish cultural environment are also affected by the basic structures of Turkish culture. The study covers the reflection of 'kut' understanding, which is one of the elements of Turkish culture, to today's management science.

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Gönderilme Tarihi: 2 Ağustos 2022/ Kabul Tarihi: 1 Ekim 2022

The Understanding of Kut in Turkish Culture

The word 'Kut' was used by Arsal (1947), Kafesoglu (1998) for 'political domination', meaning 'the power of power, that is, the power to govern the state'(Genç, 1981). According to Ögel (2010), 'kut' is based on the idea and philosophy of the high state. It is based on a good destiny that is directed towards success, and thus an understanding of the state and good fortune. The word Kut was used in the understanding of fortune, luck and blessings. The same approach has continued in Seljuk Turks and Ottomans. Already the 'blessed' meaning of Kut is born from the interest of God (Ögel, 2010). The word Kut, which is also encountered in Oğuz Epic, meaning 'political authority', was used in Kutadgu Bilig in particular as the Turkish equivalent of the word 'state' directly (Arsal, 1947). The ruler, who has the authority to govern, acts as an 'officer' who carries out the responsibility for the reign of God 'nasb'. It is possible for someone who has been Kut to remain ruler as long as he fulfills his duty. Otherwise, it is possible for the society to give up respect and obedience to the ruler (Kezer 1987). Khan's commandments are accepted as if they were God's commandments and they are fulfilled with the same belief (Genç, 1981). Therefore, the duty in Turkish culture is sacred. This conception of the Hun State conception, 'my reign was decided by God', The famous Khan of Göktürk state, Bilge Kagan, said: 'I sat on the throne because God willed, I put the nations on four sides in order'. 'God settled my father khan and my matron mother on the throne' and 'I was khan because I was blessed for God's will'; and it is possible to find the similar statements.

In Turkish thought, God gives 'Kut' i.e. 'political authority'. In this sense, it can be stated that sovereignty is taken from Gök (sky). According to the old Turkish conception of sovereignty, the monarch had certain qualities that God granted. According to this, the right to govern the state was donated by God as a divine grace to the Turkish monarch. In other words, the sovereignty is the sovereignty because God wills, 'kut' (the power of sovereignty), 'ideal' (destiny and fortune) and 'yarlig' (God's will and destiny) and the political power has the right to authority. So, the source of his right and authority to govern the state is God who blesses him, the origin of dominance is divine. In this respect, Turkish khan is almost like the representative of the sky on earth (Genç, 1987). The khan, who has the authority to govern, no longer acts as a theocratic representative in the name of divine grace or right, but as an 'official' who fulfills the responsibility of God's 'nasb' sovereignty. Therefore, Turkish rulers cannot be a superhuman entity. Responsibility for the duty is definite. As a matter of fact, it is possible for someone who has become a 'kut, to remain ruler as long as he performs his duty. Otherwise, it is possible for the society to leave respect and obedience to that ruler (Kezer, 1987). In Turkish thought, 'kut' (political power) is given to Kagan by God. So, the sovereignty is taken from the 'Sky'. In other words, the ruler is the ruler because God gave him 'Kut' and has the right to political power authority. In this respect, the Turkish Khan is like the representative of heaven on Earth (Genç, 1987). Khan's commandments are accepted as if they were God's commandments and they are fulfilled with the same belief. Therefore, the duty which is not only ruler but also ordinary ones in Turkish culture is sacred. That is to say all duties are sacred in Turkish Culture.

The study is based on the idea that 'kut', which is one of the fundamental elements of Turkish Management Culture, provides a reference frame that 'duty' is sacred and therefore organizations and employees in Turkish Culture act with the understanding that 'duty is sacred'. This idea is based on both paradigms emic and ethics. To be able to find out and display this thought, the difference in terms of the holiness of the duty between Turkish and western cultures in an empirical way, we decided to compare Organizational citizenship behavior in different cultures, even if it is possible to use any other variables or methods.

Organizational citizenship behavior is defined as the behavior of a person doing more voluntarily than his or her designated task, which does not require punishment unless it is done, without waiting for a response (Podsakoff et al., 2000). Organizational citizenship behavior in Turkish culture is fundamentally sacred task, so every behavior related to the task is also sacred' as a reflection of the understanding found to corresponds in the Turkish Culture. In other words, it is thought that an individual who is educated in Turkish culture will exhibit more organizational citizenship behavior than an individual who is educated in western cultures within the framework of the holiness of duty. In this context; It is based on the assumption that the mean values obtained in empirical studies on

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organizational citizenship behavior in Turkish Culture are higher than western cultures that do not get in touch with Turkish Culture.

Organizational Citizenship Behavior

Organizational citizenship behavior has been considered in the management and organization studies since the 1980s (Basım and Şeşen, 2006). The roles of the employees in the organization are determined by their job descriptions. However, roles that are not included in the job descriptions are also displayed by the employees. These roles that are not included in the job descriptions are called 'extra role behavior' or 'prosocial behavior' (Moorman and Blakely, 1995). Later, these roles were called organizational citizenship behavior (Smith et al., 1983). Organizational citizenship behaviors are behaviors that are not included in the job descriptions, do not require any punishment if not fulfilled, and that the employee voluntarily exhibits at his own volition (Podsakoff et.al., 2000). Organizational citizenship behavior can be an active role in the form of voluntary participation of employees to contribute to organizational activities or passive role in a way that avoids harmful behaviors for the organization (Baron, 2000). Organizational citizenship behavior is a variable that contributes positively to the organization in terms of its results (Podsakoff et.al., 2000).

Many aspects of organizational citizenship behavior have been identified. However, the most commonly used dimensions are Organ's (1988) ones. According to these dimensions, organizational citizenship behavior has five dimensions that are; altruism, conscientiousness, courtesy, civil virtue and gentleness. The altruism is aimed at helping other employees; conscientiousness is aimed at voluntarily exhibiting more than expected behaviors of employees; courtesy, to inform the person in advance on matters of interest to others; civil virtue, to take responsibility in matters concerning the organization; gentleness is a voluntary act to accept business difficulties and problems without complaining (Podsakoff et.al., 2000).

According to other dimensions, organizational citizenship behavior is dealt with in two dimensions (Williams and Anderson, 1991). These; organizational citizenship behavior, which consists of dimensions of self-esteem and kindness, and is displayed for individuals within the organization-organizational citizenship behavior-organization dimensions consisting of individual and consciousness, civil organizational citizenship behavior variable is considered as 5-dimensional in some studies and 2-dimensional in some studies. In this study, both kinds of studies were taken into consideration.

Method

In order to test the hypothesis, the studies on the average of the variable of organizational citizenship behavior were obtained from 'The Academic Search Complete' database of the academic studies conducted on the organizational citizenship behavior in the western culture and in the Turkish culture and the mean of the organizational citizenship behavior variable in the related studies were taken. While determining the relationship between the KUT concept and OCB, it was thought that the factors examined by the selected articles would be effective in the context of manager, trust, leadership, and justice in line with the Kut concept, and for this reason, these articles were selected. In order to determine the differences validly with t test, at least 30 samples are needed. Because of that samples of both sides are more than 30. These averages were compared with independent sample t test to determine whether there was a significant difference and by looking at the mean values, it was determined in which culture the organizational citizenship behavior variable was higher. In this study, organizational citizenship behavior studies conducted in 33 Turkish and 31 Western samples (see appendix) were compared. The sources used and the means of organizational citizenship behavior are shown in appendix.

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Hypothesis

In this study, it is assumed that culture can affect organizational behavior research and Turkish culture and western culture are compared in the context of organizational citizenship behavior. Organizational citizenship behavior has been determined to be influenced by national culture (Moorman and Blakely, 1995). Moorman and Blakely (1995) in their study of the effect of individualist and collectivist behavior on organizational citizenship behavior from the national cultural dimensions, found that collectivist culture contributes to the display of organizational citizenship behavior. Since Turkish culture is a collectivist culture and the duty is considered sacred, it can be said that it will be exhibited that more organizational citizenship behavior than the western culture, where individualistic features are more dominant.

If we examine the relationship between Organizational citizenship behavior dimensions with Kut concept it can be said that every dimension of OCB has some conceptual relations with Kut. For example the altruism is aimed at helping other employees, conscientiousness is aimed at voluntarily exhibiting more than expected behaviors of employees and courtesy is aimed to inform the person in advance on matters of interest to others. Likewise, Kut concept includes doing the best in duty and doesn't ask if the behaviour is written on the employee's work description. Kut asks only to do the best, because duty is sacred and holiness is more than work description. Other dimensions of OCB can be thought in the same way like civil virtue and gentleness. Having more responsibility and dealing with organizational problems ensure organization to be more successfull and create a place where all the employees are happy and makes a fair environment for all managers and employees. Actually Turkish management mentality which includes Kut concept, has the same purpose for all the citizens, like fair and happy in country. This mentality covers not only government but also all kinds of managerial areas, like business management. By these explanations of the relationship between Kut concept and OCB, this hypothesis can be created:

Hypothesis: Due to the fact that the task is considered sacred, more organizational citizenship behavior is exhibited in Turkish culture than western cultures.

Results

In the analyzes, the results of organizational citizenship behavior studies conducted in 33 Turkish and 30 Western samples were compared with independent sample t test. Levene's test showed that the variance between the variables was not equal and the analyzes were continued in this way. The result of the analysis is in Table-1.

Table 1. *Independent Sample t Test Results*

Culture	***N***	***Mean***	***S.D.***	***S.D.***	***T***	***P***
Turkish	*33*	*4.08*	*.34*	*53.81*	*4.307*	*.000*
Western	*30*	*3.62*	*.48*			

There was a significant difference between the studies of organizational citizenship behavior in Turkish Culture and Western Culture ($t(53.81) = 4.307$; $p < 0.05$). The average of organizational citizenship behavior studies examined in Turkish Culture (Mean = 4.08; SD =, 34) was found higher than the average of organizational citizenship behavior studies examined in Western Culture (Mean = 3.62; SD =, 48). The result obtained; in the Turkish culture where the sense of duty is high, it is pointed out that the tasks related to the task are made more willing than the western culture within the framework of organizational citizenship behavior variable.

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Conclusion

Based on the results of this study, which is relied on the hypothesis that culture affects organizational life, it is considered that it will be useful to work on the main elements of Turkish culture and their reflections on management culture in an ethical-emic perspective. For example, the issue of "trust" in social and organizational meaning can be handled on the basis of Turkish culture and reflections empirically from social culture to organizational culture. It is appreciated that examining the most fundamental element of culture and language, which is the least changing element of language and proverbs by means of content analysis, and empirically testing the findings to be obtained as a result of the examination can provide important clues in terms of evaluating the reflections of culture on management understanding.

It is possible for managers to know the cultural origins of the masses they use and lead in achieving their organizations, to realize the main points of action of these cultures and to benefit from the results obtained from such studies, and to be effective in ensuring individual-organization harmony. Similarly, it is considered that those who are administrators in other cultures will have benefits from the studies carried out in that culture.

This study is based on the idea of 'sacred duty' relied on the Turkish management culture. This idea is predicate on both paradigms, ethical and emic. In Western cultures, there is no idea of 'sanctity' about the mission, on the contrary to Turkish culture. Scales developed in western culture, regardless of culture, are used throughout the studies conducted in the field of management and organization and interpreted from an ethical point of view. However, as emphasized in this study, in fact, ethical results should be interpreted from an emic perspective. With this in mind, the organizational citizenship behavior variable found in the studies conducted in western and Turkish cultures was discussed and whether the differences between the cultures were compared. As a result, it was found that the average of organizational citizenship behavior was higher in the Turkish culture where the duty was considered sacred and there was a significant difference between the cultures in terms of organizational citizenship behavior average.

The study also includes several limitations. The study was carried out by considering the 'kut' understanding, which is one of the elements of Turkish culture, and the 'Organizational Citizenship Behavior variable, which is considered to be a reflection of this understanding in contemporary management. Therefore, the results should be evaluated in this context. In the study sample only in Turkey it was discussed in the framework of study about organizational citizenship behavior, therefore, is limited samples discussed. It is considered that conducting similar studies in all geographical regions of Turkish culture may eliminate the drawbacks of this constraint. In the empirical dimension of the study, 33 studies in Turkish culture and 31 studies in Western culture were examined. The results obtained are limited in proportion to the number of studies examined. The inclusion of all studies on organizational citizenship behavior will be a source of more meaningful results. Finally, the constraints expressed in the studies discussed in this study also apply to this study.

In social science research, it is accepted that the effect of social desirability can affect the outcome and is stated as a constraint and in this study, it was assumed that this effect could be neglected for both samples. Moreover, in this study, as a result of the cross-cultural comparison conducted within the framework of organizational citizenship behavior variable, it can be said that the results of the studies conducted with ethical understanding should be evaluated and interpreted in emic context as well.

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Appendix

Studies held in Turkish Culture		
No	**References**	**OCB mean**
1	Akdoğan, A.A. & Köksal, O. (2014). Aidiyet Algısının Örgütsel Vatandaşlık Davranışı Üzerindeki Etkisinde Yöneticiye Güvenin Aracılık Rolü. *Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* 18(1): 25-43.	3.98
2	Akgündüz, Y. & Çakıcı, A.C. (2015). Algılanan Örgütsel Desteğin Örgütsel Vatandaşlık Davranışlarına Etkisinde Örgütsel Stresin Aracılık Rolü: Beş Yıldızlı Otel İşletmelerinde Bir Araştırma. *Journal of Alanya Faculty of Business/Alanya Isletme Fakültesi Dergisi* 7(2): 29-41.	4.21
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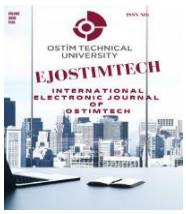

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EJOSTIMTECH, 2022; 1(1):29-34

A MIXED INTEGER PROGRAMMING METHOD FOR UNIVERSITY COURSE SCHEDULING PROBLEM

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Abstract

It is included in the class of NP-hard problems due to its course scheduling structure and it is encountered in many areas such as university, high school and working life. As the complexity of the problem increases due to the nature of the problem, it becomes increasingly difficult to reach the desired optimal solutions. In the field of education, the scheduling problem is divided into two as lesson scheduling and exam scheduling. Lesson scheduling is also divided into curriculum-based and enrollment-based. On the basis of registration, it is clear which students choose which courses and efforts are made to prevent overlaps. In curriculum-based scheduling, the course information chosen by the students is not known. In this context of obscurity, it is tried to prevent the lessons of the students who take the same course from overlapping. In this study, the course scheduling problems of the students who take curriculum-based courses in the departments of the Faculty of Economics and Administrative Sciences at a foundation university are discussed. Manually solving the problem involves a lot of staff and requirements. Therefore, it is necessary to produce a solution for the problem. Since the problem is unique for the institution, it is necessary to develop a model that will produce a solution specific to the institution. For this purpose, a mixed integer programming model was designed and solved with the help of GAMS program to solve the course scheduling problem.

Keywords: Course Timetabling, University, Mixed Integer Programming

Introduction

Scheduling problems are encountered in many fields, such as education, logistics, and health, and are usually solved by the past experience of people specialized in the field. Scheduling problems, which are combinatorial optimization problems, are NP-hard problems that are difficult to solve by nature. When there are few data and conditions, complete solutions to the problem can be found, but as the data increases, solutions cannot be found in a reasonable time. In scheduling problems, there are often multiple solutions, and it may be considered sufficient to obtain results close to the solution in a reasonable time instead of a single and complete solution (Diveev & Bobr, 2017).

The course scheduling problem is defined as placing courses, classes, and instructors in the same time slot so that they do not overlap under ideal conditions. In the available solution space, a time slot location with no overlap can be considered as a solution. University course scheduling, which is a derivative of scheduling problems, is a difficult optimization problem due to the constraints of classrooms, class hours, and lecturers (Muklason, Irianti, & Marom, 2019). Course scheduling problems in universities and schools typically follow the following algorithmic sequence. First, the issue is handled on a departmental level. That is, each department within the faculty develops its own program, which is then combined. The main disadvantage is that there are not enough resources in the desk area after one department creates its own schedule and passes it to the other department. In this case, the previous schedule must be revised once more. During this time, there is a significant loss of time and workload. As a result, a feasible holistic solution should be obtained within an acceptable time frame.

Scheduling problems, as an optimisation problem, are concerned with the efficient allocation of resources. Many constraints are considered during the scheduling process. Resources are typically limited, and two tasks can be scheduled concurrently at a given time. Artificial intelligence optimisation

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Gönderilme Tarihi: 7 Ekim 2022Kabul Tarihi: 10 Kasım 2022

in solving these problems algorithms such as the Genetic Algorithm, Tabu Search, Ant Colony Optimization, Particle Swarm Optimization, and Artificial Bee Colony are widely used. It is critical to investigate how to implement mix integer programming(mip)-based methods and whether MIP-based methods can achieve the same level of success as other methods in other training scheduling areas.

One of the most important administrative tasks that every university must perform during the academic year is assigning courses to specific time slots and classrooms. Due to the unique characteristics of educational institutions, different studies have emerged and there are many ongoing studies today. The main reason behind this is that the course curricula are constantly updated and new courses are included in the curriculum or courses that are no longer required are excluded from the curriculum.

In this study, an attempt was made to develop a model based on the requests of four departments within the Faculty of Economics and Administrative Sciences. The first section of the study explains who created the model, and the second section explains the model. The model is then applied and solved using the GAMS package program in the following section. The findings and recommendations are presented in the final section.

Literature Review

It is difficult and takes a lot of time for educational institutions to schedule classrooms and capacities, taking into account the needs of instructors and students. Since each institution has its own characteristics, it is not possible to create and implement a standard model. For this reason, the feasibility of the problem attracts the attention of many researchers. (Schaerf, 1999) grouped the course scheduling problem under three headings: course, school-time, exam scheduling. Although they have some common aspects, all three types of problems show significant differences.

School scheduling aims to make a weekly lesson schedule for all classes within the school. Among the important points is the prevention of teachers being assigned to different classes at the same time. At the same time, two teachers are not given to a single class. A detailed study for the problem can be found in the study of (Kingston, 2012).

University course scheduling is a course scheduling that minimizes the overlap of courses with students taking common courses within a faculty or faculty (Botsali, 2000). Exam scheduling is the scheduling of courses with common students by avoiding overlapping of exams and by creating a dispersion of exams across opportunities (Carter, 1986) (Qu et al., 2009). Although there are many intersections between exam and course scheduling, there are also important differences where they differ from each other. For example, in course scheduling, a course is given to a classroom, while in exam scheduling, if the capacity of the classroom is sufficient, more than one course exam can be held in the same classroom. The most obvious difference between course scheduling and school scheduling is that there are students who take common courses at the university. In schools, classes consist of separate students. In other words, if the students of the two courses are common, these courses overlap. They cannot be placed on the same timeline.

University course scheduling class is included in NP-hard problems (Bardadym, 1996). To explain, we have K courses and placing these courses in D classrooms in S time periods means that (S*D)C alternative solutions emerge. As the size of our variables increases, the number of solution candidates will increase.

Many different methods such as heuristics, metaheuristics, and mathematical models have been used in course scheduling problems. (Daskalaki et al., 2004) developed a 0-1 MIP model for the course scheduling problem in their study. Using the goal programming method (Günalay & Şahin, 2006), proposed a solution to the Turkish Military Academy course scheduling problem. (Schimmelpfeng & Helber, 2007) created and implemented a MIP model at Hannover University's Faculty of Economics and Business Administration. They turned this model into a decision-support system and made sure it was used at the university. (Oladokun & Badmus, 2008) created the MIP model in their study and used it in the University of Nigeria, Faculty of Engineering, study for the lessons they organized. (Al-Qaheri, Hasan, & Al-Husain, 2011) at Kuwait University's Faculty of Business Administration, they created a decision support system for course scheduling. Integer goal programming is used to build the model,

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and assignments are made in three stages: faculty-course, course-time slot, and time slot-class assignment. They tried to minimize this by adding a cost function to the model they developed. (Gunavan et al., 2012) proposed a mathematical model in their study and focused on improving its solution with the help of annealing simulation. (Sánchez-Partida, Martínez-Flores, & Olivares-Benítez, 2014) created a MIP model and solved the UPAEP University course scheduling problem. (Phillips, Waterer, Ehrgott, & Ryan, 2015) investigated the issue of class assignment to courses. For the existing problem, a MIP model with a general structure that can be used for large instances is developed. They proposed a new model that can be solved by the model. (Vermuyten, Lemmens, Marques, & Belien, 2016) proposed a MIP model with two stages. The classrooms and times of the courses were determined in the first stage, and the number of students switching between the courses was minimized in the second stage based on the results of the first stage. (Siddiqui, Raza, & Tariq, 2018) developed a web-based decision support system based on the MIP model they developed for the lesson scheduling problem and implemented it in their universities. They provided course schedule preparation with this study, in which they proposed a new multi-purpose model.

The studies presented above are based on integer models. In this study, the model developed by (Castillo and Alguacil, 2002) for the course scheduling problem was taken into account, and additional constraints were added and rearranged in the model considering the conditions specific to the institution. Two objectives were defined in the model and they were tried to be minimized.

Methodology

Many previous studies have been done and models have been proposed for the course scheduling problem. It has been clearly demonstrated that these models proposed during the implementation phase will yield effective results. Most organizations still try to solve the scheduling problem manually. In this case, too much time and effort are spent to solve the problem, and as a result, a suitable satisfactory solution cannot be found.

In this study, the scheduling situation that a foundation university wants to create for a certain day of the week is discussed. There are 4 departments in total within the Faculty of Economics and Administrative Sciences, and a total of 9 instructors in these departments have the capacity to teach all 30 courses to be given. Instructors consist of faculty members from the faculty or from another institution. Which lecturer will teach which course is taken by the faculty decision. At the same time, these 30 courses were determined as common courses by the four departments. Course hours start at 8 am and end at 18 pm and each course is set to two hours. There is a decision by the faculty administration that each course should be given once and that any department should teach a maximum of 3 courses per hour. Ultimately, an appropriate scheduling solution needs to be devised. For this task, 3 employees are involved in the university and they spend a lot of time. In order to solve the problem in the shortest time frame and to eliminate the loss of workforce, it is important to model the problem effectively and find a solution.

The parameters, constraints and objective function of the course scheduling problem of the four departments of the Faculty of Economics and Administrative Sciences of the foundation university are given below:

Parameters

S_{dr} : The number of classrooms (The representation of the classrooms where the courses will be given is expressed with dr. It will be as Sdr = {classroom1, classroom2, …, classroom6}.)

S_s : The number of course hours (The hours that the courses will be given are expressed in s. The course hours for a day are shown as Ss = {08-10,10-12,12-14,14 16,16-18}.)

S_d : Number of courses (Indicates the number of all courses to be given by the instructors. It is shown as Sd = {course1, course2, …, course30}.

$S_{öd}$: i. Number of courses given by the instructor

S_{bs} : Number of departments (It is the number of departments in the faculty. Sbs = {department1, …department4})

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Π : The set of all lessons to be given (Π = {d1, d2, …, d8})

Πi : i. course set given by the instructor (Π1= {d1, d2, d3}, Π2 = {d4, d5, d6, d7}, Π3 = {d8, d9, d10, d11}, Π4 = {d12, d13, d14, d15, d16}, Π5 = {d17, d18, d19, d20, d21, d22}, Π6 = {d23, d24, d25}, Π7 = {d26, d27}, Π8 = {d28, d29}, Π9 = {d30})

Δb : Course set of section b (course set of section 1 Δ_1 = {d1, d2, …, d10}, the course set of part 2 Δ_2 = {d11, d12, …, d17}, the course set of part 3 Δ_3 = {d1, d19, …, d23}, the course set of part 4 Δ_4 = {d24, d25, …, d30})

Note that $\Pi_1 \cup \Pi_2 \cup \Pi_3 \cup \Pi_4 \cup \Pi_5 \cup \Pi_6 \cup \Pi_7 \cup \Pi_8 = \Pi$ and $\Delta_1 \cup \Delta_2 \cup \Delta_3 \cup \Delta_4 = \Delta$

Decision Variables

The 1-0 decision variable, which shows which course should be given at which time and in which classroom, is expressed below:

V(*d, dr, s*): 1 if course *d* is given in the *dr* classroom at hour *s*, 0 otherwise.

Constraints

Although some aspects of each university are similar, there are some differences between them. These points can also be assigned to faculty, departments, lecturers, classrooms, and working hours. As a result, presenting a comprehensive integer linear programming model that includes every university is impossible. The model to be installed should be custom-made for the institution. Because of the inadequacy of classrooms and a lack of instructors, complexity emerges in our problem. The constraints that meet all the needs of the desired course scheduling problem of the Faculty of Economics and Administrative Sciences are given below:

In constraint (1), each instructor teaches all courses.

$$\sum_{d \in \pi_i} \sum_{dr=1}^{S_{dr}} \sum_{s=1}^{S_s} V(d, dr, s) = S_{\ddot{o}d} \qquad \forall i \tag{1}$$

In constraint (2), each instructor teaches at most 1 course in a time period.

$$\sum_{s \in \pi_i} \sum_{dr=1}^{S_{dr}} V(d, dr, s) \leq 1 \qquad \forall s, \forall i \tag{2}$$

In constraint (3), each course is given once.

$$\sum_{dr=1}^{S_{dr}} \sum_{s=1}^{S_s} V(d, dr, s) = 1 \qquad \forall d \tag{3}$$

In constraint (4), a maximum of 1 course is taught in each class-hour combination.

$$\sum_{s \in \pi} V(d, dr, s) \leq 1 \qquad \forall dr, \forall s \tag{4}$$

In constraint (5), a maximum of 3 courses of any department are taught every hour.

$$\sum_{d \in \Delta_b} \sum_{dr=1}^{S_{dr}} V(d, dr, s) \leq 3 \qquad \forall s, \forall b \tag{5}$$

Objective Function

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The objective function tries to minimize two different objectives. It is focused on minimizing the number of classrooms to be used and course hours.

$$Min \sum_{d \in \pi} \sum_{dr=1}^{S_{dr}} \sum_{s=1}^{S_s} (dr + s) V(d, dr, s)$$

Application

The model presented was solved with the GAMS package program using a PC with 12GBRAM, 2.26 GHz processor. The solution was found in 0.13 second. As a result of the problem solved for 6 classrooms, 5 course hours (between 08-18), 30 courses, 9 instructors and 4 departments, all courses were assigned to fill all time periods and all classrooms for one day. The results of the objective function are shown in Table 1.

Table 1. Course Scheduling Results

	08-10	**10-12**	**12-14**	**14-16**	**16-18**
Classroom1	Course 20	Course 21	Course 15	Course 9	Course 16
Classroom2	Course 13	Course 18	Course 24	Course 28	Course 1
Classroom3	Course 8	Course 2	Course 29	Course 27	Course 7
Classroom4	Course 6	Course 26	Course 3	Course 17	Course 30
Classroom5	Course 22	Course 5	Course 4	Course 12	Course 11
Classroom6	Course 10	Course 14	Course 19	Course 23	Course 25

The table shows which instructor is teaching which course in which classroom and at what time. Table 2 shows, for example, the classrooms and hours of the first lecturer's courses.

Table 2. Program for 1st Instructor

	08-10	**10-12**	**12-14**	**14-16**	**16-18**
Classroom 1	-	-	-	-	-
Classroom 2	-	-	-	-	Course1
Classroom 3	-	Course 2	-	-	-
Classroom 4	-	-	Course 3	-	-
Classroom 5	-	-	-	-	-
Classroom 6	-	-	-	-	-

Conclusion

The course scheduling problem encountered in educational institutions is a difficult problem to be overcome at the beginning of the education period for every university. One of the most difficult aspects of the problem is that the curriculum is constantly updated and the optimum course scheduling table found in the previous year loses its functionality the next year. Due to the fact that the departments in the FEAS in the university where the study was conducted were located in a single building, many courses were given jointly and the instructors gave courses to more than one department, it was necessary to consider the problem as a single problem for the faculty. It has been decided that the common courses within the faculty will be given a single day of the week and that the classrooms will be equally distributed to 4 departments for each day on the other days. The aim of the study is to schedule 30 courses for this determined single day. In the study, two different objectives were determined and the most appropriate solution of these objectives was found in line with certain constraints. The related study was carried out in line with the requests of university departments. In future studies, it is thought that a better study can be done in line with the information obtained from the students. In future studies, we hope to convert this system into a web-based structure that universities dealing with similar issues can easily access. Following the development of this decision support system, course schedules in accordance with departmental rules and instructor preferences can be obtained in a timely and efficient manner.

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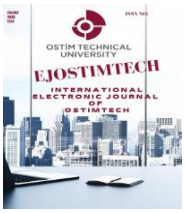

OSTİM TECHNICAL UNIVERSITY

EJOSTIMTECH International Electronic Journal of OSTIMTECH

EJOSTIMTECH, 2022; 1(1):35-50

BLOCKCHAIN TECHNOLOGIES: A LIGHT ON FUTURE WORKS[1]

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Abstract

Blockchain is a data recording system which supports cryptocurrencies and makes it difficult to alter or hack the transactions or engage in fraudulent activities. This technology supports technical properties such as distributed systems, decentralization, time-series data and asymmetrical encryption. Blockchain technology is a competitive technology which have changed social, commercial, and technical fields and is expected transform financial and commercial infrastructure of societies in the future. This study aims to identify the advantages of the blockchain technology in terms of future ways of doing business, its possible disadvantages as well as the gaps in the literature which require more focus in future research. Based on the literature review and a keyword search in the Web of Science database, a list of topics was drafted to provide direction for researchers that are interested in the fields of blockchain and cryptocurrencies.

Keywords: Blockchain, Finance, Management, Auditing, Accounting

Introduction

Technological innovation is considered the primary driver of long-term economic growth. Today, innovation is moving at a faster pace than it has ever been. This pace has resulted in the emergence of the blockchain technology, which is considered the most significant invention since the invention of the Internet. A cryptocurrency payment method called “Bitcoin” was created based on the blockchain technology by a person or group named Nakamoto in 2008 and provided the opportunity to broadcast all transactions on a network (blockchain) in a public manner (anonymously) which allows all users on the network to track all other transactions. Bitcoin has made it possible to transfer all information, data, and money between two parties (peer-to-peer/P2P) on an online platform without being dependent on any authority.

Blockchain technology can be defined as a new generation business process improvement software and as a collaborative technology, blockchain is capable of improving the business processes among companies and is of great importance for almost all sectors since it provides transparency of data, accountability of transactions, unmediated processes and data symmetry. Blockchain applications are categorized as Blockchain 1.0, Blockchain 2.0 and Blockchain 3.0. Bitcoin and other cryptocurrencies constitute the Blockchain 1.0 as the first and the most widespread implementation of the blockchain technology (Mainelli and Smith 2015). Blockchain 2.0 involves smart contracts enabled by Ethereum. Decentralized Autonomous Organizations (DAOs), decentralized applications (DApps) and decentralized autonomous corporations, (DACs) are also classified under Blockchain 2.0 (Swan, 2015). In addition to Ethereum, other projects such as Hyperledger and Codius which created a programmable contract language and an executable infrastructure for the integration of the blockchain technology into smart contracts have led to a noteworthy progress in this area (Xu et al., 2019). And finally, the

[1] This work was supported by Research Fund of the Ostim Technical University. Project Number: BAP202201.

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implementation of the blockchain technology in areas other than finance and cryptocurrencies such as education, healthcare, agriculture and tourism is called Blockchain 3.0. One of the most important elements of Blockchain 3.0 is the token projects. Any person, institution or organization can create their own token project by using a blockchain network for which Ethereum and the ERC20 standard has the most widespread use. Tokens secure intellectual and property rights while allowing for the validation of securities such as stocks and bonds. NFTs (Non-Fungible Tokens), a recently popularized type of token has become rather valuable in terms of showing what the blockchain technology can do. An NFT is an asset kept on the blockchain with a unique identification code which allows for transfer among multiple owners, but its copyright remains unaltered. In 2021, Mike Winkelmann, also known as "Beeple" has brought the spotlight on this token with his NFT Project called "First 5000 days" which was sold for $69,346,250. The blockchain ensures the uniqueness of the NFT, which usually involves but is not limited to works of art. These NFTs can be sold on platforms such as SuperRare, Nifty Gateway, Rarible, Enjin and Decentraland. NFTs can be created in very short periods of time by using individual accounts and wallets since complex programming languages are not required for producing NFTs. There is also an NFT validation mechanism established in Turkey called "NFT Studyo Türkiye" which answers the need for distinguishing fake and original artworks (Doğan et al., 2022).

Cryptocurrency projects have started in 2008 with Bitcoin and reached approximately 16.000 projects in 2022. Today, the blockchain technology has reached the point of individual and corporate investments for conducting research in all fields besides finance and cryptocurrencies. At this point, it seems almost impossible to stay away from this technology which will alter and transform the ways of doing business, research fields and even the daily life. It is evident that persons and institutions integrated into the blockchain technology will have notable advantages and that many firms operating in various sectors are now investing in blockchain research to lower their transaction costs, accelerate the pace of transactions, diminish the risk of fraud and remove intermediaries. This brings out the importance of understanding the blockchain technology, increasing awareness about this technology and identifying the gaps in the literature.

Understanding the Blockchain Technology

Blockchain is a database technology which verifies and stores data by using encrypted chain block data structure; creates and updates data by using a distributed node consensus algorithm; ensures data transmission and access security by using cryptography; and programs and processes data by using smart contracts (Cheng and Huang, 2019: 64). Blockchain allows for the development and coordination of new and sustainable business models. It supports optimization, sharing and virtualization and creates a driver for reaching sustainability goals. In this regard, blockchain is a coordination tool for connecting and coordinating multiple distributed and updated databases (Mercuri and Ricci, 2021).

Compared to a traditional database, blockchain database ensures accuracy, authenticity and up-to-dateness of data. Blockchain database is different compared to an independent database or a spreadsheet where a user can make unsupervised changes (Drescher, 2017). All blocks since the initial block of the network are added to the chain and then recorded by all nodes. As a decentralized and distributed database, blockchain is a shared ledger which does not require any authority. Each page is added as a block to this ledger (Deng et al., 2018) which enables the firms to organize their work while also making intellectual property and payment processes transparent and automatic and lowering transaction costs (Felin and Lakhani, 2018). If and when legal regulations are put into force, firms will be able to declare their taxes automatically via smart contracts and the everlasting problem of tax evasion will be solved (Vishnevsky and Chekina 2018). Blockchain is regarded as a technology which will initiate industrial and commercial revolution and instigate a worldwide economic reform (Chang et al., 2020: 2).

Firms create their own network structures by using blockchain technology and acquire entrepreneurial financing by issuing tokens. They store, transfer, and sell the tokens and coins they have created to solve their financial challenges and meet their financing needs. ICOs (Initial Coin Offering) or token sales provide a new type of fundraising tool which has emerged with the goal to meet the funding needs of entrepreneurs and newly established companies. In other words, ICOs provide a crypto crowd funding tool. Entrepreneurs who issue tokens and coins use these funds to develop the projects

they have manifested in their whitepapers and ensure sustainability. ICOs create large amounts of capital mobility (Deng et al., 2018) and offer benefits to not only small-scale start-ups but also their affiliated companies and investors while also allowing for the development of FinTech (Financial Technology) and innovative and useful projects. This results in the development of projects beneficial to the whole society. Stages of the ICO process are presented in Figure 1.

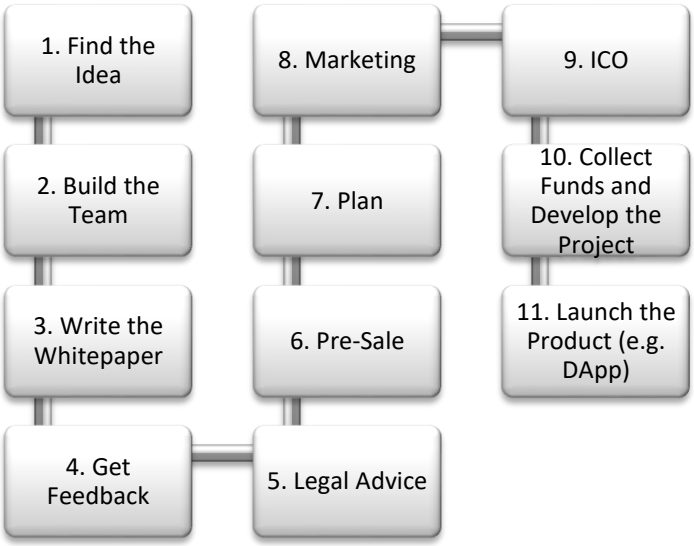

Figure 1. ICO Process

Source: Deng and Huang, 2018.

As depicted in the figure, ICO is a crucial step in any blockchain based project as it provides the funding required for the actual project to be implemented. However, it must be preceded by various other carefully calculated stages such as writing the whitepaper, marketing and pre-sale. These stages create the basis for a successful ICO process which in return brings in the funds needed for the project.

Following section provides a literature review on the changes and advantages to be brought by the blockchain technology on future ways of doing business.

Advantages of Blockchain Technology for Future Ways of Doing Business

Invention of the Internet has fundamentally changed the ways companies acquire, create, and protect value followed by the concept of business models which has brought another dimension to this process of value creation. Blockchain technology, on the other hand, is regarded an even more advanced technology than artificial intelligence and robotics which will fundamentally transform future business models and it has become vital for institutions and organizations to build and develop their own blockchain networks to gain competitive advantage (Schlecht et al., 2021; Khanh, 2016: 51–54).

According to the results of a study conducted by Deloitte and TÜSİAD (Turkish Industry and Business Association), while the blockchain technology has many implications in different areas, the financial sector will be the most affected by blockchain technology with 78%, followed by information technologies with 60% and supply chain and logistics with 59%. The results of the survey are shown in Figure 2.

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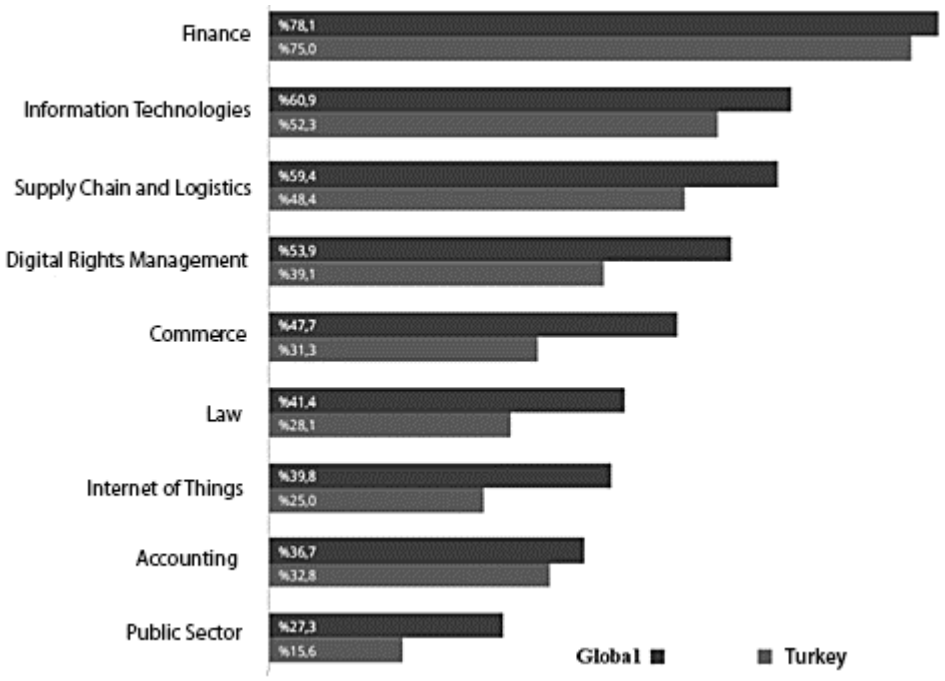

Figure 1: Areas to be Affected by the Blockchain Technology

Source: Deloitte- Tüsiad, 2018.

Accountability and efficiency is expected to increase as blockchain technology provides a secure and robust environment for data, transparency in processes, minimal risk, and flexibility against external threats (Demirkan et al., 2020: 192). Unless more than 51% of the nodes in the system are manipulated, no changes can be made to the records in the database, thus reducing the possibility of incorrect data in the system. In other words, the error rate decreases since blockchain databases record digitally signed data in real time (Salah et al., 2019: 10130). At the same time, fraud and erroneous registrations will be prevented as each new block must be verified by multiple nodes to be added to the chain (Gomber et al., 2018: 220-265). Particularly regarding the financial sector, in the future, it may be possible to increase the efficiency of stock exchange transactions, offer cheaper financial services, and record transactions automatically in the future. Manipulation of data will be prevented, and transactions will be better protected than by financial and regulatory authorities. (Khanh, 2016: 51-54). The areas that will contribute most to the growth and development of blockchain technology are also the areas that will be most affected by that technology. (Piscini, 2017).

Digital Identity

Identity verification is among the most compelling problems of today's world. Identity theft, use of fake identities, CVs or diplomas create a major issue which affects even the most popular websites and social media platforms. Therefore, many entities, particularly financial institutions, invest great amounts in technologies such as Know Your Client (KYC) and Anti-Money Laundering (AML). There are certain recommended digital identity applications such as "Sora Identity" which is a mobile application claiming to solve such problems and allows each individual to sign their own identity cards and decide with whom their information will be shared. Sora uses Hyperledger Iroha blockchain platform for its digital identity protocol (Takemiya and Vanieiev, 2018). Similarly, Estonia begun using the blockchain technology for the notarization of personal data regarding the e-residency program (Sullivan and Burger, 2017). This enables validation of diplomas and valuable papers without the need for a notary.

Blockchain provides a digital identity which can be used to define not only individuals but also institutions. Identities of various persons, institutions and entities engaged in any commercial or

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industrial activity are validated on a general network similar to the Internet. As digital identities will be expanded to include property and object identities, they can be issued by a government agency, such as a driver's license, passport, corporate records, and property deeds (Al-Jaroodi and Mohamed, 2019).

Transition from Risk Control to Full Control and Cost Reduction

Audits that impact executive decision-making processes and control plans and processes are nowadays conducted as risk audits. Audit risk in many cases is fraud risk. Listed companies may engage in fraudulent transactions to cover up losses or inflated profits or manipulate their financial statements. Such fraudulent behavior is often carefully planned and done covertly, not only manipulating financial data but also falsifying original documents. This type of fraud is difficult to detect even for highly experienced auditors, even if they have performed adequate audit procedures. Therefore, the audit may fail. In addition to the risk of fraud, incomplete and falsified data are also common in traditional audits. In traditional audits, the auditee's financial data is typically copied and transferred to audit software used for data processing and analysis. The likelihood of data loss is high in this process. Without comprehensive and complete financial data, auditors are more likely to issue an incorrect audit opinion, and audit risks may change accordingly.

Today, audits in many countries are still performed by on-site audits using traditional methods. The labor and time costs of an on-site audit are quite high. The time required to audit a company's annual report can vary from one week to two or three months, depending on the size of the company and the complexity of its economic activity. In terms of labor costs, the traditional audit workload is overwhelming. Many auditing procedures cost auditors time and effort and the audit of a company's annual report is performed by an audit team of at least 3-5 people. If a company is planning an IPO (Initial Public Offering), the audit process will involve an audit team of more than 10 people. Audit costs are mainly based on verifying the authenticity and accuracy of the audited company's economic activity through external confirmations and evidence. During external confirmations, which is a very reliable audit procedure, the auditors often apply several correspondence procedures for the balance of accounts receivable, accounts payable and bank balances in order to verify the authenticity of the data. Moreover, the auditor cannot guarantee that the confirmation letter is 100% reliable. In the blockchain system, all financial information can be verified by other nodes and is irreversible. Each transaction is cryptographically signed and verified by all mining nodes, which keep a copy of the ledger containing the chain blocks of all transactions. This creates secure, synchronized, and shared records with timestamps that cannot be changed (Salah et al., 10128: 2019). As a result, auditors can fully rely on this financial information, eliminating many unnecessary audit procedures and reducing audit time, which significantly reduces the staff and resources needed to test the reliability of financial information (Cheng and Huang, 2019: 65).

In traditional auditing, there are limitations in terms of sampling. In other words, a portion of invoices are audited using sampling procedures and techniques. It is not possible to check all invoices, vouchers, information, and documents as it requires time and effort. Therefore, the audit is a risk audit and cannot provide 100% assurance. Such an audit is not an absolute guarantee; it only provides reasonable assurance. The limitations of traditional audit procedures expose auditors to higher audit risk. Blockchain technology solves these problems. Above all, for fraud risk, any change in financial data is broadcast throughout the network, and all nodes receive the message about the data change. The data will not be stored unless all nodes in the network validate it. When relevant supervisors and regulators are integrated into the blockchain network, all business decisions of the company are tracked in real time. Abnormal behavior is continuously monitored, and on-site auditing is ensured. This reduces post-event risks and not only regulating authorities, but also all other nodes in the network can perform such an auditing function, effectively limiting the financially fraudulent behavior of companies. And even if the company has actually deleted or falsified financial data, the blockchain system leaves traces so that auditors can easily find and track these changes and determine the reasons behind them. As long as auditors are authorized to log into one of the public ports, they can query all financial data since the creation of the blockchain structure. This financial data is permanent, immutable, and reliable which makes it possible to conduct a complete audit because the financial data that auditors receive is comprehensive and accurate.

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A traditional audit is an investigation of the audited entity's past economic activities, with a certain time lag that gives the entity time to manipulate and delete financial data. Data transmission takes time. For example, a transaction on a company's bank statement may be recorded by the bank, but not by the company. Before the bank statement is sent to the company, it is difficult for the company to recognize this problem and create the accounting entry. This not only causes the financial data to be delayed in the company's books, but also harms its accuracy. The auditor can audit the company by monitoring the blockchain in real time when the company records and stores all transactions in the blockchain, data on each node is updated in real time and the blockchain data is self-sufficient with time stamps. The company has no time to manipulate or delete data, and the risk of financial fraud is reduced. At the same time, in terms of information delay, the data transfer in the blockchain system is in real time. The transaction is distributed to other nodes as soon as there is an entry in the bank account and the transaction is automatically recorded and updated in the company's general ledger. All financial information in the company's ledgers stay up-to-date and accurate in real time. These features of the blockchain enable real-time auditing

Audits are conducted by covering a certain time period. According to the agreements among companies and audit firms, an audit team plans the process for 3-6 months and carries out the audit activities on site. With blockchain technology, audits are performed instantly without being limited to a specific period as full-time records are collected in more than one node. When an activity takes place at any node of the blockchain network, all nodes of the network get notified of the change. After validation, data for the economic activity is not only stored in the ledger of the current node, but also automatically copied and stored in the ledgers of the other nodes. This network-wide updating of data is done in real time. This function ensures comprehensive auditing while also lowering audit costs. Cost reductions are achieved especially in terms of auditing and verification of transactions (Michelman, 2017).

Transparency and Traceability

Blockchain is a very open and transparent database. All data on the blockchain is public, just like the Bitcoin blockchain, depending on the consensus algorithm used. In addition to the private information of the two parties of the transaction, anyone can query all network data in the blockchain database via a public port.

The data in the blockchain is integrated into a chain structure in chronological order. Each blockchain has a timestamp that records the time information generated by the network, and this timestamp is irreversible. Such time series data cannot be deleted or modified after it is created. Blockchain keeps a record beginning with the generation of the network which allows for the recording and validation of all transactions without any modification and this feature enables the traceability of the data. Each node in the blockchain system keeps a transparent ledger which contains all the data since the creation of the network.

Studies in health and supply chain occupy an important place among those demonstrating the benefits of using blockchain technology in terms of transparency and traceability. Research shows that the use of blockchain technology for improving clinical medical research will benefit transparency, especially in terms of patient consent (Benchoufi et al., 2017). It has been proven that the chronological record-keeping function of blockchain technology ensures traceability of food from production to consumption in the supply chain, prevents post-modification of chemical analysis results and prevents food adulteration, which is of great importance to consumers. It creates a common language across the food chain. End-to-end traceability is ensured, and thanks to the blockchain, consumers can easily access the stages of food production on their mobile phones. Food storage temperature, production farms, shipping information, and factory processing information can be transparently followed at all stages (Galvez et al., 2018). Implementation of blockchain technology ensures the elimination of intermediaries in the agri-food sector; increases the traceability of useful information by reducing transaction times and costs and contributes to sustainability (Mercuri and Ricci, 2021).

Table 1 demonstrates the solutions provided by blockchain technologies in terms of conventional traceability issues.

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Table 1. Blockchain Solutions for Traceability Problems

Problem	Solution
How can individual activities be coordinated over the Internet without secure centralized storage?	Blockchain uses chronologically distributed databases where blocks are linearly connected to each other and cannot be deleted.
How can entries be validated without a central authority to verify that a transaction is not fake or invalid?	Blockchain uses a probabilistic approach. It forces the information circulating over a computer network to be more transparent and verifiable by using mathematical problems that require a significant amount of computational power to solve.
How can we make sure that only legit transactions are recorded on a blockchain?	A new data block is added to the end of the blockchain only after computers on the network reach a consensus on the validity of the transaction. Consensus within the network is achieved by different consensus algorithms.
How can the historical entries be protected?	Once a block is added to a blockchain, it cannot be deleted. In addition, the transactions it contains can be accessed and verified by anyone on the network. It becomes a permanent record that all computers on the network can use to coordinate an action or validate a transaction.

Source: Galvez et al., 2018

Immutability and Security

The consensus algorithms of blockchain networks (proof of stake or proof of work) do not allow faulty or fraudulent transactions or manipulation of information. Consensus is needed for an information to be recorded on the network and when there is no consensus among users, the network automatically rejects the input as invalid (Casey and Vigna, 2018). It is not possible for a single user to create a record individually. Consensus algorithms allow transparent sequential recording of transactions only after they are confirmed by users. Transactions are stored by all users on the network which makes them difficult to change, as it requires excessive processing power (Atanasovski et al., 2020: 738). Besides, cyber attacks require consensus from 51% of the users on the network. For an erroneous, fradulent or manipulated data to be recorded, the chronologically recorded data in each user's ledger needs to be altered or deleted, which is almost impossible (Al-Jaroodi and Mohamed, 2019). Another important point is that a malfunction in a single user's ledger will not cause a change or malfunction in other ledgers and moreover, failure of a single node does not affect the operation of the entire network (Chen et al., 2018: 4). As a result of the use of an external hash tree in a distributed ledger structure for increasing security, the system does not allow any employee or institution to make manipulative transactions in the database or processes and therefore it does not carry the risks that may arise in transaction validations under a single manager in a traditional structure (Pinna and Ruttenberg, 2016).

Efficiency

Conventional banking transactions can be made between certain hours of the day. This causes delays in money transfers and commercial transactions between countries. Blockchain network, on the other hand, allows transactions to be made at any time of the day and week which ensures efficiency in the operations of MNCs (Multinational Companies) particularly in import-export transactions and foreign trade financing. Thanks to smart contracts, time loss is reduced as transactions are carried out automatically (Wang vd., 2016: 5).

Business processes with multiple stakeholders such as individual users, commercial firms and government agencies are inefficient due to the multilateral authorization of commercial transactions. Integration of blockchain technologies with artificial intelligence makes decentralized autonomous

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organizations (DAO) possible for fast and automatic verification of data/asset/value transfers among different stakeholders (Salah et al., 2019: 10130).

Blockchain Technology: Possible Disadvantages

Blockchain technology has a great potential to change all ways of doing business. Despite the negative perception of countries and central banks regarding cryptocurrencies, the reason why they allow the use of this technology is mainly because they want to see what this technology is capable of. However, the fact that countries have not yet made any legal regulations in this regard as well as the lack of intellectual capital, i.e. professional manpower, high energy costs and high risk of asset loss are among the possible disadvantages of the technology (Drescher, 2017). The need for new governance models and acceptability problems are also mentioned as barriers to implementing this technology. (Batubara et al., 2018). Possible disadvantages of the blockchain technology identified in the literature are discussed in the following sections.

Lack of Regulations

Emergence of capital inflows without any transnational regulation through cryptocurrency ICOs force the securities market, central banks and regulatory institutions to focus on this issue. Although crypto assets and the blockchain technology ecosystem behind it have advanced globally, the fact that there is neither any implementation framework nor any national and international legislation causes individuals and institutions to implement a wait-and-see policy. Considering the rapid development of technology as well as the number of projects and the size of the market, applying a wait-and-see policy will result in a waste of time for individuals, institutions, organizations, and countries (Cumming et al., 2019).

High Energy and Data Storage Costs

Since all users on the blockchain network work to validate all transactions, it consumes more electricity than any single database and this amount of energy consumption results in high costs while also creating a notable carbon footprint. Executing and storing big data costs much more than storing transaction data. (Chang et al., 2020: 3). In blockchain platforms using the proof-of-work consensus algorithm, the requirement for all users on the network to validate the transactions on all blocks since the beginning of the network causes the energy consumption to be high. Therefore, the adoption of blockchain technologies by institutions and organizations depends on building large scale storage systems and expansion of computer processing powers (Dai and Vasarhelyi, 2017). As an alternative solution to this problem, the proof-of-stake consensus algorithm has been developed in which data hashes are linked to blockchain blocks or used within the blockchain smart contract code to lower the costs (Kokina et al., 2017; Salah et al., 2019). Moreover, the proof-of-stake algorithm does not require the validator to spend computational power (as in proof-of-work algorithm) but requires them to hold a certain amount of assets.

Transaction Per Second Limit

Requesting the transaction validation of all users in the blockchain network prevents it from performing swiftly and the continuous increase in the number of transactions causes the network to slow down. Platforms with higher transaction rates per second such as Ethereum, Quorum and Hyperledger have been developed as a solution to the transaction limit on the Bitcoin platform.

Risk of Losing Assets

In Blockchain wallets, cryptocurrencies are secured using a cryptographic key and it is mandatory for users to protect these keys to protect their assets. When users lose the key, they also lose their assets. While central institutions such as banks protect their customers in terms of the security of their assets, the decentralized structure of the blockchain creates a high risk of asset loss.

Integration Problems

Blockchain technologies are not standalone applications, they are often integrated into systems used by firms such as ERP and CRM. They help influence emerging functions to support future business

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models. However, the process of integrating the blockchain technologies into applications used within the organization is not very easy. Interoperability and security-related problems are among the most significant problems which may arise as the applications used are not ready to adapt to the new technology. At the same time, the use of different programming languages by the developers of the old and the new technology may create another problem and complicate the integration of programs. Therefore, the integration model to be used should ensure the reliability and accuracy of the functions of the applications used as well as the consistency of the business data among all applications. It is important to develop effective models in the integration of blockchain technologies into industry applications (Al-Jaroodi ve Mohamed, 2019).

Interoperability Problems on the Blockchain

Many platforms are developed for the adoption and implementation of blockchain technologies by different organizations or individuals by utilizing various standards. This raises the issue of interoperability. The fact that each institution and organization creates its own blockchain network makes it difficult for these networks to do business with each other (Atanasko et al., 2020: 743). An industry-wide standard blockchain may be more efficient and provide benefits for all stakeholders across an industry (buyers, sellers, investors, regulators, auditors) (PWC, 2018).

Scalability Problem

Adding a block to the blockchain network is a lengthy and complex process because it is recorded in previous blocks but for a blockchain of limited size, this is effective. However, when recording on the blockchain network, problems arise in locating, verifying, or using previous transactions. This is because this process requires many steps, and it is problematic because it is negatively correlated to the size of the network. In other words, as the size of the blockchain network increases, the process slows down. As the number of network participants and transactions increases, scalability becomes an important issue (Al-Jaroodi and Mohamed, 2019). There are currently more than 1 million smart contracts being executed on the Ethereum blockchain. Thousands of platform developers and entrepreneurs are continuously creating new projects and ventures based on the Ethereum platform. The fact that Visa executes 24.000 transactions per second, PayPal carries out 193 transactions per second whereas Ethereum and Bitcoin only conducts 20 transactions per second demonstrates how millions of transactions cannot be handled in a short period of time (Chang et al., 2020: 3). Another aspect of scalability is size and storage requirements. Since copies of all transactions are kept by all participants, the size of the ledger increases in direct proportion to the number of participants. (Atanasovski et al., 2020: 740). The Lightning Network was developed as a solution to this problem to increase the capacity of the blockchain to millions of transactions per second (Kokina et al., 2017: 94).

Lack of Professional Labor

The development, use, and application of blockchain technologies requires a professional workforce trained in the field. In addition, application on an industrial level and integration into systems depends on having teams with knowledge in this area. Education and training of technical professionals is important for the adoption of this technology. In this regard, it is essential to update the curricula at universities, supplement the courses that teach technological knowledge, and include theory and practice in the course content. The establishment of blockchain engineering departments at universities to train people to work in this field as well as the establishment of centers where relevant research and projects will be carried out will contribute to the adoption of the technology.

Competition and Transparency

Blockchain networks can be created publicly, privately, or as a consortium. Bitcoin, the first blockchain network, emerged as a public platform. Public networks have a structure where all information is available to all users. This may cause challenges regarding sharing information that will affect the competition among institutions and organizations. Therefore, private and consortium blockchains have been developed to solve this problem. Companies that will take part in the blockchain network can decide with whom and what information they will share (Andersen, 2016). This allows for the transaction data confidentiality with two separate blockchains where users can view encrypted

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transactions and check the consistency of the network (Dai and Vasarhelyi, 2017). Another blockchain structure is zero-knowledge proof consensus (Wang and Kogan, 2018).

The enactment of the General Data Protection Regulation (GDPR) hindered further adoption of blockchain technology. Blockchain architecture allows all users to record information. According to the regulation, this is undesirable in terms of confidentiality and protection of data. The inclusion of consumer information is considered worrisome in terms of data privacy (Forbes, 2018).

Security Problems

Research shows that public blockchains, where transactions are verified on a proof-of-work basis, have governance issues. One of the users in the blockchain network can seize control of sufficient mining power to deliberately alter the software, consensus or confirmation of transactions to the detriment of other participants, for personal benefit. This is called a 51% attack and is a fundamental security issue (Kokina et al., 2017). This type of attack is a very expensive strategy in the public blockchain architecture. However, there are also types of sabotage which may be organized by one of the users. One of the nodes may misrepresent its capabilities among other nodes and upload a false code to get validation (Yermack, 2017). Low-cost strategies can also be developed to install low-quality software to the detriment of other members of the network. In addition to being a new technology, Blockchain has a constantly evolving and changing architecture. Blockchain leads to up to 80% change and up to 20% innovation in business processes. Blockchain technology is not just applied to solve specific problems that arise in the industry but also enables the development of new ways of producing services and new cooperation models within and between companies. It is a powerful tool for recreating the corporate culture for companies undergoing technology transformation as it leaves authority and trust to decentralized networks (Mougayar, 2016).

Problems with Smart Contracts

Smart contracts occupy an important place among the innovations produced by the blockchain technology. Once defined, smart contracts are self-executing and self-managing contracts without the need for the approval of a notary public or any other authority. For example a lawsuit can be filed or a compensation can be paid automatically when certain conditions are met. Smart contracts, which have a significant impact on the emergence of smart marketplaces, perform transactions without the need for human intervention, guarantor or approval. In this context, IoT (Internet of Things) provides the opportunity to certify automatically occurring events through smart contracts and without human intervention (Mercuri and Ricci, 2021).

The use of smart contracts is costly since miners must complete calculations to ensure contract execution. It is also regarded as main vulnerability of the system (Kokina et al., 2017). In order to solve the security problems related to smart contracts, research should be done and the problems should be resolved. It is possible to code fraudulent transactions that do not conform to the true nature of the relations established between the parties by the users. Users may verify the transaction if they think it is reasonable. However, it should be noted that such fraudulent transactions in smart contracts can be detected as they are recorded and cannot be changed. (Atanasko et al., 2020:745).

Risk of Illegal Activities

The decentralized nature of the blockchain increases privacy and since it provides confidentiality, it is used for illegal activities. Tracking illegal transactions on blockchain is more difficult than tracking banking transactions. Arrangements should be made to prevent money laundering, drug trafficking and financing of terrorism. The benefits of blockchain technology should be increased.

Gaps in the Literature for Future Studies

Blockchain is currently a very popular research topic in almost all areas ranging from engineering to business, law to medicine, agriculture to architecture and many more. A search on the Web of Science database with the keyword “blockchain” indicates that, as of 2022, there are 11,691 articles published in journals included in the Web of Science database most of which are covered in

SCI-E, ESCI and SSCI indices (Web of Science, 2022). This demonstrates the importance and prominence of the topic and the need for more studies in this field.

In the scope of this study, a literature review was conducted combined with a comprehensive search on the Web of Science database using the keywords "blockchain" and "cryptocurrencies" and their variations. Previous studies were reviewed, and the recommendations included in these publications for future studies were examined. Topics derived from this research were categorized based on their relevance and divided under four groups. Table 2 provides the list of topics.

Table 2. Topics for Future Research

Category 1: Understanding the Blockchain Technology	
1	What can we learn from the evolution of a groundbreaking technology? Is blockchain going to do to the financial systems what Internet has done to the media?
2	Who is in control of the blockchain?
3	Security issues in public and private blockchain networks
4	Factors affecting the adoption of the blockchain technology
5	Simulation tools for the blockchain technology
6	Industrial applications of the blockchain technology
7	Integration of the blockchain technology with Internet of things (IoT) and artificial neural networks
Category 2: Cryptocurrencies	
1	Cryptocurrencies in position to other currencies in the economy
2	Crypto-currency or crypto-asset?
3	Accounting and reporting of cryptocurrencies
4	Cryptocurrencies in international trade
5	Cryptocurrencies in terms of the risk of laundering of proceeds of crime
6	Cryptocurrencies in financing of terrorist actions
7	Analysis of the relationship among cryptocurrencies, exchange rates and marketable securities
8	Causality and cointegration relationship between cryptocurrencies and commodity prices
9	Dominance of Bitcoin over other cryptocurrencies: The impact of Bitcoin on other altcoins
10	Relationship between cryptocurrencies and macroeconomic indicators
11	Impact of cryptocurrencies on central banks and other banks
12	Analysis of perception levels of cryptocurrency investors
13	E-businesses and cryptocurrencies
Category 3: Blockchain and the Business World	
1	The impact of blockchain on the future of management
2	Blockchain and business ethics
3	The impact of blockchain on the future competencies of employees

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4	Blockchain and career management
5	Blockchain and international private law
6	The impact of blockchain on financial systems and costs
7	Blockchain and auditing
8	Blockchain and digital marketing
9	Blockchain in public administration
10	The impact of blockchain on logistics and sustainable supply chain management
11	The impact of blockchain on arts and crafts
12	The impact of blockchain on energy efficiency and trade
Category 4: The Future of Blockchain	
1	The impact of legislative regulations on the growth of cryptocurrencies
2	The relationship between blockchain, entrepreneurship and innovation
3	Blockchain based virtual reality and Metaverse
4	Possible impact of blockchain on future ways of doing business
5	Possible impact of blockchain on future leadership styles
6	Possible impact of blockchain on customer relations
7	Possible impact of blockchain on employment
8	Blockchain and universities of future
9	The impact of blockchain on business education
10	The impact of blockchain design education

Topics listed in Table 2 try to draw a picture of the gaps in the literature that require more research. These topics were determined as prominent fields of research that were either completely overlooked in the literature or were somewhat mentioned but still require more attention. The first category involves topics about the basics of the blockchain technology. Although there currently is a significant and growing literature about the topic, there is still room for improvement. The second category covers cryptocurrencies, which is the field where the blockchain technology has its most widespread and penetrating use and therefore requires the most attention. As it affects all financial systems and thereby almost every human being on the planet, this area of research should be probed thoroughly. The third category covers the impact of the blockchain technology in ways of doing business with a focus on specific fields and sectors that are mentioned less in the literature. And finally, the fourth category is focused on foresights on the future impact of the blockchain technology. Based on its evolution, the blockchain technology is expected to affect many more areas in the future and these topics are among the ones that require the most immediate diligence.

Conclusion

With the development of blockchain technology, a new way of doing business has emerged. This has led to changes in the functioning of many public and private institutions and the way they do business. Cryptocurrencies have rapidly become widespread around the world. Despite the risk of cryptocurrencies being used in the financing of terrorism, money laundering and illegal works, the most important reason why countries and especially central banks do not prevent this progress is the desire to see what the blockchain technology behind cryptocurrencies is capable of. This study aimed to provide a basic overview of the technology with its advantages and disadvantages and shed light on the gaps in

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the literature to expand the field and encourage researchers to focus more on this growing area of research.

It is evident that the use of blockchain technology, especially on a social level, has increased in recent years. This technology will continue to do so in the coming years as it changes and transforms the social, commercial, and technical fields. Collaborative leadership, lack of regulatory frameworks, low levels of use, insufficient professional workforce, and difficulty in cross-country cooperation affect the adoption of blockchain technology. Making plans for providing solutions to all these problems will benefit the adoption of the technology. In this context, it is very important for academics and practitioners to create a blockchain application framework together, to evaluate suggestions and opinions from experts in the field, and to prepare a comprehensive blockchain adoption framework to integrate technology into existing applications.

In the future, all companies, institutions, and organizations will create their own blockchain networks. In order not to lag behind technology, to keep up with the future, and to seize opportunities, efforts should be undertaken to establish blockchain networks. Companies should create blockchain labs, in cooperation with universities to invest in blockchain startups, and set up their own blockchain teams to advance their position in the new blockchain industry. Investing in this technology will enable companies to stay a few steps ahead of the competition. Insufficient investment in information technology is among the most serious problems of companies. In order for companies to increase their competitiveness in the local and international arena, they need to strengthen their knowledge building.

Research shows that many countries, institutions, and organizations adopt a wait-and-see policy to implement blockchain technology and make any moves in this regard. The wait-and-see policy will make it too late to be a part of the blockchain technology, which is developing very quickly.

One of the most important problems in the adoption of technology is the lack of professional workforce. For this purpose, blockchain engineering departments should be established in universities, and courses on blockchain and cryptocurrencies should be included in the curricula of undergraduate and graduate programs. Organizing seminars and courses, providing trainings and raising awareness to increase the level of knowledge on this technology will facilitate the adoption of technology.

In the future, management of technology, employees and culture change will gain importance. Organizations adopting blockchain will need to evolve and manage technology, culture change, and people on blockchain. Knowledge building can ensure knowledge circulation within the company, reduce costs and increase efficiency.

Blockchain technology needs to modernize the curricula of faculties in universities to meet the professional workforce needed by companies. Research focuses only the future uses of blockchain technology and the changes and transformations that will occur in future professions and business life whereas curriculum changes on the applications of blockchain technology are not included. Curricula need to be redesigned. While designing the curricula to prepare newly graduates for the market and ensure their employability, the academia should consider how new technologies will be integrated into existing industry practice. The topics listed in this study try to provide recommendations for future research. These topics, combined with evidence from real application examples of blockchain technologies should be evaluated in future research.

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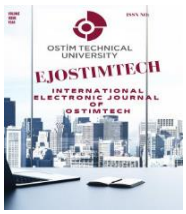

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EJOSTIMTECH International Electronic Journal of OSTIMTECH

EJOSTIMTECH, 2022; 1(1):51-61

CLASSIFICATION OF FOUNDATION UNIVERSITIES BY CLUSTER ANALYSIS ACCORDING TO ACADEMIC, FINANCIAL AND ADMINISTRATIVE INDICATORS

Serdar Çelik*

Abstract

The study's goal is to examine Turkey's 76 foundation universities using cluster analysis and classify them within the framework of selected variables based on academic, financial, and administrative indicators. Variables accepted as academic, financial, and administrative indicators were clustered in the study using Ward's method and the k-mean method. The most up-to-date data published on the Higher Education Institution (YÖK) website was used as the data source. 76 universities were grouped into six clusters according to the hierarchical clustering analysis using 13 academic, financial and administrative indicators. Then the k-means method was applied. The efficiency of the academic, financial and administrative variables of the universities in the formed clusters was determined by the results of ANOVA. While performing hierarchical clustering methods, standardization process was applied to the data. At the same time, it was determined which method would be applied depending on the observation data, variable data type and number. As a result of this study, in which two clustering methods were studied, different clustering structures were obtained for both methods.

Keywords: Cluster Analysis, Foundation University, Ward's Method, K-Means Method

Introduction

Universities are institutions where raw data is transformed into information and produced, vocational training is received, and new technologies are developed. These higher education institutions contribute directly to the economy and development of the cities, regions and countries in which they are located. Universities vary in terms of both their founding goals and their vision. It has become organizations that not only produce information, but also work in interaction with the environment they live in, transform their experience into marketable products and act for the benefit of society together with stakeholders. Higher education in Turkey has been a service provided by the state until thirty years ago. In recent years, the inability to meet the increase in demand has led to the establishment of foundation universities with some regulations. Foundation universities are established by non-profit foundations and their number is increasing every year. Due to this increase, foundation universities have become an important research area in terms of academic, financial and administrative criteria. University rankings are one of the most important goals of universities. Because universities have different outputs and objectives, rankings may be insufficient to describe a university's status. In addition to university rankings from a research standpoint, it is critical to evaluate universities using a variety of criteria that are applied equally to all universities. The metric system used to rank universities does not account for all aspects of university productivity (Raan & F. J., 2005; Pérez-Esparrells & Orduna-Malea, 2018). As a result, universities should not be evaluated solely on their overall score. As a result, universities should not make university ranking their primary goal. we must evaluate universities based on their respective objectives. Universities should be evaluated based on their own goals.

Literature Review

Classifying universities is an effective strategy for controlling institutional characteristics in academic research and developing internal policies. Academic, administrative and financial performance measures are the driving force for decision makers while developing these policies. Measuring institutional academic performance in an objective, accurate, honest and reliable way helps to allocate resources efficiently, prioritize research and development investments, to inform all stakeholders, to attract potential candidate students, and improve institution self-assessment. Classifying

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Gönderilme Tarihi: 24 Eylül 2022/ Kabul Tarihi: 10 Kasım 2022

universities is recognized as an effective strategy for internal policy development in higher education (Shin, 2009). This is because classification provides transparency for various internal policy approaches and collaboration among institutions (Bartelse & Vught, 2007). Early classifications for universities were categorized in terms of their similarities and differences. Recent classification studies have focused on research performance. A classification study should be closely related to its intended use. Local or global ranking lists attract the attention of the public and academia. The rankings provide easily understandable and interpretable information about the university. It also helps to encourage competition and make a difference among universities. States use rankings for allocating resources and for quality assessment. Employers consider rankings to recruit recent graduates. Students who want to get into universities with high reputations use rankings. However, rankings may be subject to criticism regarding the choice of indicators. Descriptive approaches are insufficient to make the complex structure of universities understandable (Raponi, Martella, & Maruotti, 2016). This is because ranking systems use quantifiable data and different calculation formulas rather than qualitative data. Therefore, as a way of comparing universities, cluster analysis techniques should be used rather than a simple ranking algorithm and focusing on their identified areas. In studies on clustering universities, researchers have been interested in classifying universities on an institutional basis. Bartelse and Vught (2007) examined the indicators of classification in five dimensions: education, innovation, R&D, staff characteristics, and institutional variables. Many factors, such as existing criteria and variables, must be taken into account to create a useful classification. Universities often avoid doing an entire institution analysis because they have strengths in one area. Therefore, typical academic research performance indicators include publication numbers, citation counts, journal impact factors, and reputation rankings. Higher education institutions in Turkey offering associate, bachelor's, master's and doctoral programs are designed as public universities and foundation universities under the supervision of YÖK. The operating revenues of state universities are provided by the state without any specific performance evaluation, while foundation universities are funded by their founders or co-founders, tuition fees and other revenues. While the revenues of foundation universities are provided by stakeholders, they are calculated by taking into account the institutional size and expenses of the university rather than performance. Küçükcan and Gür (2009) provide a comparative analysis of management systems in higher education, while Günay and Günay (2011) investigate quantitative developments. Using data from 2010 and 2013, Tosun (2015) analyzed the current state of public universities in six categories: educational income, educational structure, educational quality, publications, projects, and entrepreneurship-innovation. The lack of a classification scale for Turkish universities imposes limitations on academic research as well as global policymaking. In the absence of a classification scale for Turkish universities, researchers and policymakers are forced to work with an arbitrary comparable grouping. Such a practice may lead to inconsistent results. The purpose of this study is to investigate and analyze variables and indicators for classifying foundation higher education institutions in Turkey on the basis of academic, financial and administrative indicators and to classify foundation universities using a cluster method.

There are two research questions in this study:

1. What are the indicators that can be used to classify foundation universities in Turkey?

2. How can universities be classified with quantitative variables?

In the next section, the data used in the analysis and the clustering methodology are explained. Then the clustering findings are presented and discussed. The paper concludes with some conclusions and recommendations for decision makers.

Research Method

The main purpose of this study is to classify foundation universities in Turkey in terms of academic, financial and administrative variables. In cluster analysis, first of all, robust data sets are required. The data sets were created based on the literature. Ağıralioğlu (2012) outlined 13 requirements for a top university. Language, history, fundamental sciences, original school, department, institute, information and communication resources, financial resources, faculty, staff, and students, scientific publications, citations, and patents, publicity and outreach, university-society ties, and government ties are some of these criteria. According to academic standards such student enrollment, faculty and program enrollment, the number of master's and doctorate programs offered, faculty membership,

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publications, and projects, Gözükara (2015) analyzed 72 foundation universities. Elbawab (2022) conducted a clustering study that took into account variables such as academic reputation score, faculty student score, citation score per faculty, and international student score. The developed framework is constructed with the following variables:

x1: Total number of students

x2: Number of permanent lecturers

x3: Number of permanent faculty members

x4: Library area

x5: Number of printed books

x6: Number of E-Books

x7: Total covered area per student

x8: Full scholarship rate

x9: Current expense per student

x10: R&D and library expenditures total

x11: Contribution of student income to total income

x12: Advertising promotion expense

x13: Student societies

variables are considered.

In the second step, data were collected from YÖK statistics. According to the academic, financial and administrative indicator variables, the full data of 76 foundation universities were reached. Many algorithmic methods come to the fore for cluster analysis. These algorithms are grouped under two main topics (Ma, JN, & Tavares, 2009). The first is hierarchical clustering methods that generate dendrograms and non-hierarchical clustering methods. The common purpose of the methods is to maximize the differences between the clusters and the similarities within the clusters. Which method to use is generally related to the number of clusters, as well as it is useful to use both analysis methods together. Thus, it is possible to compare which one gives more appropriate results (Johnson, 2002).

In the study, Ward's method, which is frequently used among hierarchical clustering analysis methods, and k-means method from non-hierarchical clustering methods were used. Although Clustering Analysis is classified in many ways in the literature, it is commonly seen that it is evaluated in two major groups: hierarchical and non-hierarchical clustering methods. When evaluating hierarchical methods in the context of clustering units, they involve a series of n-1 clustering decisions that transform units into a hierarchy or a tree structure, where n is the number of units. Hierarchical clustering is classified into two types: combinatorial and divisive. Combining methods begin with each observation forming a cluster on its own. It then merges the two most similar clusters at the same time, bringing the clusters together until a single cluster is formed. Single linkage, full linkage, average linkage, Ward, median centralisation, and centroid methods are examples of combining methods. Divisive methods begin with a single cluster that contains all of the units and progress through successive divisions, first into two clusters, then three clusters, and so on, until each is a single-member cluster. Non-hierarchical methods, in contrast to hierarchical methods, do not use stepwise processes. Instead, after determining the number of clusters, observations are assigned to them. Non-hierarchical methods that are widely used include k-means, medoid, fuzzy, and stacked clustering. Due to a lack of a certain number of clusters, it was decided to use the hierarchical clustering method in the study. One of the hierarchical clustering methods is the Ward method, which is used to cluster units with different variance structures within a cluster. It was chosen because it clusters the clusters in a way that reduces variability. In addition, the k-means method, a non-hierarchical method, was used to compare the clustering results. The Ward and k-means methods are explained in the sections that follow.

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Hierarchical Cluster Analysis

Hierarchical methods are used to form the cluster tree in hierarchical clustering analysis. The results of hierarchical methods are displayed in tree diagrams known as dendrograms (Hubert, 1974). Grouping (agglomerative) and partitioning (divisive) clustering algorithms are two types of hierarchical methods. Grouping clustering algorithms assume each point in the initial database to be a cluster and form new clusters by merging these clusters. Partition clustering algorithms take all of the points in the initial database and form k clusters by discarding points that are different from each other. According to Figure 1, agglomerative methods move from left to right, while divisive methods move from right to left. As illustrated in the figure, divisive clustering methods perform reverse clustering, so computer package programs used in cluster analysis applications avoid divisive methods in favor of agglomerative methods. The procedure for repeatedly applying hierarchical agglomerative methods begins with accepting each observation as a cluster, i.e. the number of observations equals the number of clusters. Using the similarity measure, the number of clusters is reduced by merging the most similar clusters. The process is then repeated at each step, merging the two most similar clusters into a new cluster, until all observations are found in a single cluster (total n-1 times) (Hair, Black, Babin, & Anderson, 2014).

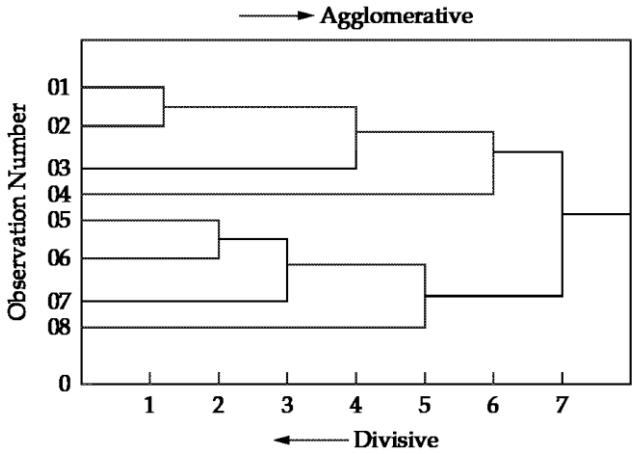

Figure 1. Dendrogram for the hierarchical clustering procedure (Hair, Black, Babin, & Anderson, 2014)

Ward's Method

Ward's method, which is one of the hierarchical clustering methods, is widely regarded as the most effective (Hands & Everitt, 1987). This method, among agglomerative clustering methods, can provide cluster formation by minimizing intragroup dispersion in each pairwise merger using the classical sum of squares criterion. Ward's method, as a result, has a more complex structure than other hierarchical methods. The goal of this method is to reduce the variance between objects by grouping them together. As a result, it considers the average distance between observations in a cluster's center and observations in the same cluster (Tekin & Gümüş, 2017).

Non-Hierarchical Cluster Analysis

Non-hierarchical clustering methods are used when the number of clusters is fixed. When the number of units is large, non-hierarchical clustering methods are faster and more meaningful than hierarchical techniques. The k-means method is the most commonly used method in non-hierarchical clustering analysis. Non-hierarchical methods, unlike hierarchical methods, do not have a tree-like structure. Instead, the researcher determines the number of clusters and then assigns units/objects to clusters. Non-hierarchical methods are becoming increasingly popular today. Non-hierarchical methods are thought to have several advantages over hierarchical techniques because the clustering process is dependent on the researcher making decisions based on objective or theoretical assumptions. The results, for example, are less sensitive to data outliers, the distance measure used, and the inclusion of irrelevant or inappropriate variables. Furthermore, because non-hierarchical methods do not require the calculation of similarity matrices across all observations, but rather only the similarity of each observation to the cluster centers, they can be used to analyze extremely large datasets. Although non-hierarchical

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approaches have numerous notable advantages, they also have limitations. Non-hierarchical approaches are not efficient for analysing a large number of potential cluster solutions. Unlike hierarchical techniques that provide all feasible cluster solutions in a single analysis, each cluster solution is a separate analysis. Therefore, non-hierarchical procedures are not thought to be well suited for investigating a large range of possibilities.

K-Means

MacQueen (1967) described the traditional k-means algorithm, which is now one of the most widely used clustering algorithms. Every to cluster numerical data where the cluster has a center called the mean designed. The number of clusters in a non-hierarchical clustering analysis should be known in advance by the researcher. When the number of clusters is known in advance, the k-means method can generate at least two clusters and as many as the number of observations. This method minimizes differences between data in the same cluster while increasing differences between data in different clusters (Al Kindhi, Sardjono, Purnomo, & Verkerke, 2019). In multidimensional space, x_1, x_2, …, x_n are observation vectors of p variables each, and a_{1n}, a_{2n}, …, $a_k n$ are cluster centers for each group of individuals in the same space.

$$W_n = \frac{1}{n}\sum_{i=1}^{n} min_{i\leq j\leq k} \left\|x_i - a_{jn}\right\|^2$$

Individuals or objects are assigned to the nearest cluster according to the rule (Gürsakal, 2019).

Data and Findings

Universities not only produce knowledge, but also play an important role in working in interaction with the environment they are in and transforming the experience gained into marketable products and providing various benefits to society together with the stakeholders. The descriptive statistics of the variables related to the academic, financial and administrative indicators used in the study are shown in Table 1.

Table 1. Descriptive statistics of academic, financial and administrative indicators

Variables	N	Min	Max	Average	Standard deviation
x1 (Total number of students)	76	378	39392	8502.41	8571.788
x2 (Number of permanent lecturers)	76	24	1634	370.14	292.950
x3(Number of permanent faculty members)	76	1	878	212.03	168.546
x4 (Library area)	76	250	12500	3440.41	3152.778
x5 (Number of printed books)	76	1428	513060	62068.71	85207.814
x6 (Number of E-books)	73	21	7771598	428769.62	1012258.682
x7 (Total indoor space per student)	76	3	92	17.43	15.689
x8 (Full scholarship rate)	74	15	100	19.30	11.467
x9 (Current expense per student)	71	3175	124358	23362.13	22265.356
x10(Total R&D and library expenditures)	71	16174	129085193	11866488.20	23440579.46
x11(Contribution of student income to total income)	71	2	99	72.20	25.243
x12 (Advertising promotion expense)	71	34158	9877054	1748122.75	2083971.891
x13 (Student societies)	76	6	114	44.62	26.449

Ward's method was applied to the data used in the study. Ward's method has been preferred because it gives more accurate and best results in clustering small amounts of data. The square Euclidean distance was preferred in the calculation of the distance values between the data values in Ward's method. However, since the incremental clustering methods, which include distance calculations, are very sensitive to the differences between the variables, it was deemed appropriate to standardize the data. For this reason, z values were found by standardizing the data and analysis was applied.

After the observation data were standardized, Ward's method was used with square Euclidean distance. According to the square Euclidean distance, in the pairwise comparison of the academic, financial and administrative variables of the universities, the lowest distance value was found to be 0.391643 between TED University and Istanbul Gedik University. This is followed by Istanbul Rumeli

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University - Eurasia University with a distance measure of 0.59064; Lokman Hekim University – Piri Reis University is followed by 0.641876. When looking at the highest distance values; It is seen that there is too much distance between İhsan Doğramacı Bilkent University and Ibn Haldun University and other universities.

When dendrogram showing the hierarchical clustering results of the universities is examined, the universities that are most similar to each other in terms of academic, financial and administrative indicators form clusters at a distance of 1 unit, while the universities that are the least similar to each other are gathered at a distance of 25 units. While the academic, financial and administrative variables of some universities are very similar to each other, they form a group at a distance of one unit, while some universities seem to be a single group at first due to their unique variables. When there is a distance of 25 units in the dendrogram, all universities form a single cluster. As a result of dendrogram, it was decided that the optimum number of clusters is 6 in the range of 1-14 units. Dendrogram results are given in Table 2 and Figure 2.

Table 2. Ward's Method Results (Universities in Clusters)

Cluster-1	Cluster-2	Cluster-3	Cluster-4	Cluster-5	Cluster-6
İstanbul Gedik	KTO Karatay	OSTİM Teknik	İstanbul Bilgi	Beykent	Koç
TED	Özyeğin	İstanbul 29 Mayıs	İstanbul Kültür	İstanbul Gelişim	Sabancı
Yüksek	Altınbaş	İstanbul Ticaret	Nişantaşı	Bahçeşehir	İhsan Doğramacı
Beykoz	Biruni	Fenerbahçe	Üsküdar	Yeditepe	Bilkent
MEF	İzmir Ekonomi	Konya Gıda ve Tarım	Atılım	İstanbul Aydın	İbn Haldun
Avrasya	Haliç		İstinye	İstanbul Medipol	
İstanbul Rumeli	İstanbul YeniYüzyıl		İstanbul Okan	Başkent	
Kapadokya	İstanbul Arel		İstanbul Sabahattin Zaim	Maltepe	
İstanbul Kent	Işık		Doğuş		
İzmir Kavram	Kadir Has				
Alanya Akev	Nuh Naci Yazgan				
Lokman Hekim	Hasan Kalyoncu				
Piri Reis	İstanbul Esenyurt				
Demiroğlu Bilim	Ufuk				
Sanko	Acıbadem Mehmet Ali Aydınlar				
Toros	Bezm-i Alem Vakıf				
Türk Hava Kurumu	TOBB Ekonomi ve Teknoloji				
Kocaeli Sağlık ve Teknoloji	Çağ				
	Antalya Bilim				
	İstanbul Ayvansaray				
	Fatih Sultan Mehmet Vakıf				
	Çankaya				

In the agglomerative table, the universities with the most similarity to each other are matched according to the coefficients depending on the academic, financial and administrative indicator variables. In the agglomerative table stage, there are n-1 stages. According to this statement, there are 76-1=75 stages for universities. With the table, it can be seen at which stage the universities come together with which university. While the closest, that is, the most similar universities, form a cluster in the first place, a new university or a new cluster formed by other universities is added to the cluster. The two institutions that appear to be closest to one another, based on this methodology, are TED University in cluster 2 and Istanbul Gedik University in cluster 1. These two universities took the Yüksek İhtisas University between them in the 8th stage. In other words; The universities that are closest to each other in terms of academic, financial and administrative indicators are TED University and Istanbul Gedik University. Later, Eurasia University and Istanbul Rumeli University were found close. The farthest universities from each other are Acıbadem Mehmet Ali Aydınlar University-Atılım University and Atılım University-İbn Haldun University. As can be understood from the coefficients, universities that are closest to each other according to academic, financial and administrative variables are in the first

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place. Universities that are less similar to each other are in the next rank. The data of this table is given in Table 3.

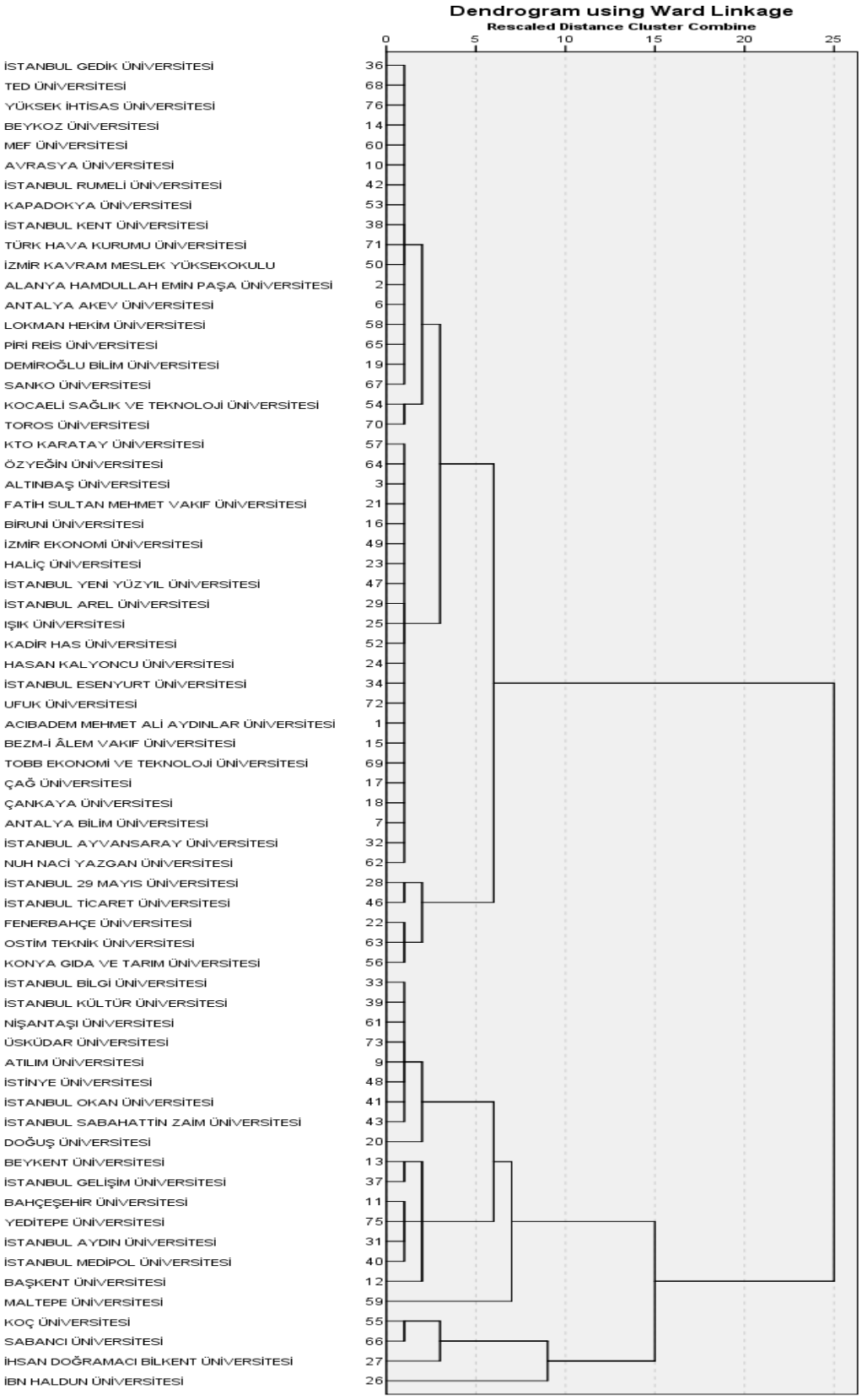

Figure 2. Dendrogram using Ward's method for clustering universities by parameters of academic, financial, and administrative indicators

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Table 3. Formation of Clusters Agglomerative Table

Stage	Merged Clusters		Coefficients	Stages of Clustering for The First Time		Next Stages
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	İstanbul Gedik	TED	0.196	0	0	8
2	Avrasya	İstanbul Rumeli	0.491	0	0	10
3	KTO Karatay	Piri Reis	0.812	0	0	17
64	İbn Haldun	İhsan Doğramacı Bilkent	496.775	0	59	65
65	Atılım	İbn Haldun	630.575	63	64	65
66	Acıbadem Mehmet Ali Aydınlar	Atılım	868.191	62	65	0

After determining the formation of six clusters according to the academic, financial and administrative variables of the universities, k-mean cluster analysis was performed. Table 4 shows the places of universities in clusters as a result of the k-means clustering method.

Table 4. Clusters after K-Means Method

Cluster-1	İhsan Doğramacı Bilkent			
Cluster-2	İstanbul Gedik TED Yüksek Beykoz MEF Avrasya İstanbul Rumeli Kapadokya İstanbul Kent İzmir Kavram Acıbadem Mehmet Ali Aydınlar	Alanya Akev Lokman Hekim Piri Reis Demiroğlu Bilim Sanko Toros Türk Hava Kurumu Kocaeli Sağlık ve Teknoloji İstanbul Esenyurt Ufuk Fatih Sultan Mehmet Vakıf Çankaya	Özyeğin Altınbaş Biruni İzmir Ekonomi Haliç İstanbul Yeni Yüzyıl İstanbul Arel Işık Kadir Has Nuh Naci Yazgan Hasan Kalyoncu Çağ TOBB Ekonomi ve Teknoloji	İstanbul 29 Mayıs İstanbul Ticaret Fenerbahçe Konya Gıda ve Tarım Atılım İstinye İstanbul Sabahattin Zaim Doğuş Antalya Bilim Bezm-i Alem Vakıf KTO Karatay İstanbul Ayvansaray
Cluster-3	Maltepe			
Cluster-4	Koç, OSTİM Teknik, Sabancı, Yeditepe			
Cluster-5	Bahçeşehir, Başkent, Beykent, İstanbul Aydın, İstanbul Bilgi, İstanbul Gelişim, İstanbul Kültür, İstanbul Medipol, İstanbul Okan, Nişantaşı, Üsküdar			
Cluster-6	İbn Haldun			

The academic, financial and administrative indicators of the universities used in the cluster analysis and the clusters formed and their averages are given in Table 5.

Tablo 5. Last Cluster Centers

Indicators	Cluster1	Cluster2	Cluster3	Cluster4	Cluster5	Cluster6
x1 (Total number of students)	0.397	-0.321	0.401	-0.379	1.957	-0.819
x2 (Number of permanent lecturers)	1.304	-0.307	1.085	0.070	1.643	-0.741
x3 (Number of permanent faculty members)	0.889	-0.328	1.328	0.202	1.659	-0.676
x4 (Library area)	2.849	-0.289	0.583	1.008	1.259	-0.302
x5 (Number of printed books)	5.293	-0.217	1.117	0.838	0.611	-0.314
x6 (Number of e-books)	0.638	-0.103	7.254	-0.150	-0.314	-0.348
x7 (Total indoor space per student)	2.139	-0.167	-0.219	0.992	-0.554	4.753
x8 (Full scholarship rate)	0.148	-0.157	-0.375	0.148	-0.222	7.038
x9 (Current expense per student)	1.101	-0.153	-0.198	3.580	-0.368	2.403

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x10 (Total R&D and library expenditures)	5.001	-0.296	-0.024	2.091	0.431	-0.197
x11 (Contribution of student income to total income)	-1.553	-0.002	0.666	-1.315	0.636	-2.781
x12 (Advertising promotion expense)	-0.477	-0.371	3.901	-0.444	1.446	-0.816
x13 (Student societies)	2.170	-0.212	0.203	-0.704	1.404	-1.082

* Data pertaining to academic, financial and administrative indicators were found with z values.

When the averages of the variables given in Table 5 in six clusters are examined, the lowest averages of x11 (contribution of student income to total income), x12 (advertising and promotion expenses) of the universities that make up the first cluster, x5 (number of printed books), x10 (total of R&D and library expenditures)), x7 (total closed area per student) and x4 (library area) are the variables with the highest averages.

Table 6.Distances Between Last Cluster Centers

Clusters	**1**	**2**	**3**	**4**	**5**	**6**
1		9.406	11.282	7.121	8.218	12.068
2	9.406		8.992	5.123	4.804	9.576
3	11.282	8.992		8.029	8.029	13.613
4	7.121	5.123	10.104		6.548	8.679
5	8.218	4.804	8.029	6.548		11.461
6	12.068	9.576	13.613	8.679	11.461	

Looking at the distance matrix between the cluster centers given in Table 6, it is seen that the distance between the first and second clusters is 9.406 and the distance between the first and the third cluster is 11.282. ANOVA test was applied to find out the difference between the clusters of the academic, financial and administrative variables of the universities used in the analysis. The ANOVA table of the variables to which the k-average method was applied is shown in Table 7.

Table 7. ANOVA Table for Variables

	Cluster		Hata			
	Mean of squares	Sd	Mean of squares	Sd	F	p
x1 (Total number of students)	10.359	5	0.277	61	37.341	0.000
x2 (Number of permanent lecturers)	7.958	5	0.464	61	17.142	0.000
x3(Number of permanent faculty members)	8.189	5	0.461	61	17.762	0.000
x4 (Library area)	6.787	5	0.563	61	12.059	0.000
x5 (Number of printed books)	7.563	5	0.546	61	13.857	0.000
x6 (Number of e-books)	10.741	5	0.288	61	37.263	0.000
x7 (Total indoor space per student)	6.962	5	0.286	61	24.368	0.000
x8 (Full scholarship rate)	10.284	5	0.108	61	94.983	0.000
x9 (Current expense per student)	9.634	5	0.334	61	28.853	0.000
x10(Total R&D and library expenditures)	8.926	5	0.402	61	22.207	0.000
x11 (Contribution of student income to total income)	4.126	5	0.767	61	5.376	0.000
x12 (Advertising promotion expense)	9.568	5	0.349	61	27.376	0.000
x13 (Student societies)	6.559	5	0.562	61	11.669	0.000

* Calculated with the z values of the data belonging to academic, financial and administrative indicators.

The ANOVA table is used to determine whether academic, financial and administrative indicator variables are significant in the clustering process. When Table 7 is examined, it is clearly seen that the academic, financial and administrative variables determined in the clustering of the universities in six clusters are significant in the clustering process ($p<0.05$). It is seen that the most effective academic, financial and administrative indicator variable in clustering is x8 ($F=94.983$). The least effective variable is x11 ($F=5.376$). Such a result is due to the maximization of the difference between clusters. That is, the distribution of universities in the clusters is not random.Cluster analysis tries to create clustering groups according to the distances between data groups.

Results and Evaluation

University rankings are an important performance measure because they are used by all universities (Elbawab, 2022). This study analyses university rankings from a different perspective. The study emphasizes that we should evaluate universities based on the defined clusters rather than their position in the success rankings.The aim of this study, which examines the academic, financial and administrative indicators of universities, is to examine which foundation universities are similar and which foundation universities are different in terms of academic, financial and administrative variables by looking at cluster analysis methods. In this study, 76 foundation universities were classified according to their academic, financial and administrative indicators. As an academic, financial and administrative indicator; total number of students, full scholarship rate, number of permanent faculty members, current expenditure per student, number of permanent faculty members, library area, number of printed books, number of e-books, total closed area per student, total R&D and library expenditures, The contribution of student income to total income, advertising and promotion expenses, student communities variables were determined and used. In the study, universities were clustered according to Ward's method and k-mean method. As the first method, Ward's method was applied and Euclidean distance was taken as a measure of distance. It was deemed appropriate that universities should be divided into six clusters. It was determined that the academic, financial and administrative variables used for clustering of universities were significantly effective ($p<0.05$). In this study, the use of cluster analysis methods in the classification of universities according to academic, financial and administrative variables was tested and the stages of the method were presented in detail. At the same time, it was determined in the study that many foundation universities were divided into meaningful clusters and few clusters depending on their academic, financial and administrative variables. According to the results, six clusters were formed in Ward's method. 18 universities came together in Cluster-1, 22 universities in Cluster-2, 5 universities in Cluster-3, 9 universities in Cluster-4, 8 universities in Cluster-5 and 4 universities in Cluster-6. It was seen that the academic, financial and administrative indicator variables that are effective in dividing the universities into six clusters with the ANOVA table are statistically significant.

The results of this study will contribute to the development of foundation universities to provide an efficient education service. Considering that the education quality and academic achievement performance of universities in the world are evaluated with different variables and criteria, it will be beneficial for foundation universities to determine their goals in this direction, to increase the quality of higher education services in Turkey and to transform universities into preferred educational institutions. The study's main limitation is that accurate data could not be obtained directly from universities. The results show that foundation universities focus on research, administrative and financial roles apart from their aims such as higher quality education. The results of this research can be extended by comparing foundation and state universities in future studies. Data from the Higher Education Institution, as well as direct data from universities, can be collected for a more comprehensive study.

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