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An Analysis of Research on The Efficiency of Higher Education in Türkiye*

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Abstract

The aim of this study is to present the general trend and direction of the research, both in terms of content and methodology, from a critical point of view by examining the studies on the efficiency of higher education in Türkiye and thus, to shed light on new research to be done and to make suggestions to researchers. Bibliographic analysis and descriptive content analysis methods were chosen in the research. Data was obtained from Web of Science, Scopus, EBSCO, ProQuest Dissertations and Theses Global, Google Scholar, Sobiad, National Thesis Center of the Council of Higher Education, TR Index databases. 70 studies meeting the determined criteria are included in this study. As a result of the research, it has been concluded that there is an increase in the number of research on the efficiency of higher education institutions, and the research focused on universities, data envelopment analysis is used more as an analysis method, the number of methods used is low, the most output-oriented BCC model is preferred among the efficiency measurement models, current data are not used in research, the number of units examined is low, and state universities are examined more. In addition to that, it has been concluded that the number of personnel, financial inputs, number of students, physical resources, the unit numbers represent almost the entire input set, and the outputs used in research are basically represented by four different outputs, which are students, research, project and publication, financial variables, and academic success, and the purpose of this study is directed to different problems, but the scope of the research can be improved.

Keywords: Education, Efficiency, Efficiency Analysis, Higher Education, Research

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Introduction

The concept of efficiency has been one of the concepts that is frequently emphasized and examined in the literature. The basis of the concept of efficiency goes back to Farrell (1957), who introduced the concept of three types of efficiency. The first of these is called technical efficiency, the second allocative efficiency, and the third total economic efficiency. Technical efficiency refers to the minimum amount of input needed to produce the maximum output using a given set of inputs or to produce a certain output level. In other words, technical efficiency is defined as the capacity and willingness of a unit to produce the maximum output with a certain set of inputs and technology (Kalirajan & Shand, 1999). Producing the maximum output using a certain set of inputs refers to the output-oriented technical efficiency. However, keeping production constant at a certain output level and reaching this production level with the least input is expressed as input-oriented technical efficiency. The second type of efficiency is allocative efficiency. Allocative efficiency refers to the choice between input combinations given their relative costs. In other words, it expresses whether the existing resources are met and whether the resources are used to produce the needed output. The third, total economic efficiency, or productive efficiency, is a type of efficiency that occurs when both technical and allocative efficiency conditions are created (Nigsch & Schenker-Wicki, 2015).

In the literature, there are many pieces of researche on efficiency on different groups, departments, institutions, and organizations. There are research on efficiency in the fields of environmental sciences (Grigoroudis & Petridis, 2019; Omrani et al., 2020; Perez-Pons et al., 2021), management (Gutierrez-Nieto et al., 2009; Maji & Hussain, 2021; Ting et al., 2021), economics (Mugera & Featherstone, 2008; Zhang, 2010), computer science (Chen et al., 2021; Gerami, 2019), health sciences (Dash et al., 2010; Moreno-Enguix et al., 2018), transportation (Ablanedo-Rosas & Gemoets, 2010; Barros & Wanke, 2016) and many more. The number of these studies shows an increase day by day.

The main reason for examining the efficiency of the units this much is to determine how effectively the resources are used, to try to produce the most output with the least input, and to try to use the least input for the output produced. In this way, first of all, resources can be allocated effectively. Second, by reducing the amount of input, the same amount of output can be produced, thus avoiding the waste of resources. Third, production capacity can be increased by obtaining more output from existing inputs. Kalirajan and Shand (1999) state that efficiency measurement has three benefits. The first of these is that it provides the opportunity to compare among similar units. With efficiency measurement, by determining the relative efficiency levels of homogeneous units with respect to each other, comparisons of units can be made among themselves. Second, at the end of the efficiency measurement, the source of the differences in efficiency between the units can be determined. Third, such analyses reveal some implications for improving the efficiency of the units. It

can reveal to what extent the examined units need to make improvements in the input and output set in order to become efficient.

Due to these benefits of efficiency analysis, the efficiency of higher education institutions also takes its place among the research subjects that are frequently examined (Agasisti & Salerno, 2007; Aleskerov et al., 2017; Choi & Ahn, 2013; Duh et al., 2014; McMillan & Chan, 2006; Tavares et al., 2018; Taylor & Harris, 2004; Turkan & Ozel, 2017). Since higher education is one of the important actors in supporting the economic development of a country (Hanushek, 2016), it is seen as the main resource for promoting innovation and social welfare (Smith, 2007).

Higher education has some features that distinguish it from other education systems (Dixit, 2002). There are multiple stakeholders, objectives and multiple outputs in higher education. Modern higher education institutions are diverse and possess multiple inputs. In some cases it also carries out activities beyond its teaching and research functions (Cohn & Cooper, 2004). Higher education institutions play an important role in increasing the competitive capacity of a society (Villano & Tran, 2021). Those interested in educational policy care about the performance of higher education. It allocates a certain number of resources to higher education in order to make higher education more productive, to improve social welfare, and to develop the necessary teaching and research functions (Agasisti & Berbegal-Mirabent, 2021). For these reasons, examining the efficiency of higher education has become the focus of research and researchers (Villano & Tran, 2021).

The subjects of research on efficiency in higher education vary. While some focus only on the efficiency of higher education institutions in a country (Agasisti & Dal Bianco, 2009; Brzezicki, 2020; Moreno et al., 2019; Salas-Velasco, 2020), some focus on the efficiency of the higher education system of more than one country and compare the efficiency of these countries in higher education with each other (Agasisti, 2011; Aybarç Bursalıoğlu & Selim, 2015; Güran & Ayranci, 2019; Kocak et al., 2019). Other research focus on specific units such as academic departments (Anastasiou et al., 2007; Kao & Hung, 2008), libraries (Reichmann, 2004; Tavares et al., 2018), and students in higher education institutions (Chen & Soo, 2010). Research on the efficiency of higher education have also been conducted on state and private universities. Whereas Kantabutra and Tang (2010), Canal et al. (2015); Sexton et al. (2012); Visbal-Cadavid et al. (2017) examine the efficiency of state universities, Agasisti and Ricca (2016); Bayraktar et al. (2013); Shamohammadi and Oh (2019), Brzezicki (2020) examine the efficiency of private higher education institutions.

Research on the efficiency of higher education also deals with issues in line with the goals of higher education. While the research by Gralka et al. (2019); Jiang et al. (2020), focuses on the research performance of higher education institutions, Agasisti and Dal Bianco (2009) and Johnes (2006) focus on the teaching efficiency of higher education institutions. Research on efficiency in

higher education also deals with various types of the efficiency. In the literature, there exist research on cost-efficiency (Abramo & D'Angelo, 2009; Agasisti & Salerno, 2007; Casu & Thanassoulis, 2006; Gimenez & Martinez, 2006), technical efficiency (Abramo & D'Angelo, 2009; Tajnikar & Debevec, 2008; Thai & Noguchi, 2021), and allocative efficiency (Caballero et al., 2004; Quiroga-Martinez et al., 2018) of higher education. When these studies in the literature are considered, it is seen that there are many studies on the efficiency of different dimensions and units of higher education.

There also exist literature reviews going through these studies. Witte and López-Torres (2017) conducted a comprehensive literature analysis of research on efficiency in education. One of the important results of the research is the use of data envelopment analysis (DEA), free disposal hull, order-m frontiers methods, which are non-parametric methods in efficiency analysis in education, and stochastic frontier analysis (SFA) method from parametric methods in efficiency analysis in education. However, as a result of the research, it was concluded that one of the methods frequently used in efficiency analysis is DEA.

Rhaiem (2017), on the other hand, systematically reviewed studies on academic research efficiency. The main purpose of the research is to reveal the reasons for the differentiation of efficiency among scientists and to examine the studies methodologically. As a result of the research, it was determined that non-parametric methods were used at a rate of 78% in efficiency research. In addition, it was concluded that the seniority of the personnel, institutional factors, the size of the university, the financing structure and scientific meritocracy were effective on research efficiency.

Villano and Tran (2021) analyzed 109 studies measuring efficiency with DEA in higher education using meta-regression, and as a result of this research, they revealed that the ranking of universities based on activity is the most studied aspect of the performance of higher education institutions. In addition, it reveals that the subject of comparing the performances of higher education institutions and identifying the sources of inefficiency constitutes the majority of data envelopment analysis studies in higher education. Therefore, this research shows that the features that will affect the efficiency scores of higher education institutions should be taken into consideration. Ferro and D'Elia (2020) examined the research on the efficiency of higher education in the context of frontier efficiency measurement methods.

Until 1998, Worthington (2001) handled the efficiency research in the field of education in terms of methodological and content, using the frontier efficiency measurement techniques. In this research, efficiency measurement methods, analysis techniques, basic findings, input/output/explanatory variables used in efficiency research were revealed. Johnes (2004) explained

techniques that can be used for efficiency measurement and described the drawbacks and uses of these techniques.

The research by Emrouznejad and Thanassoulis (2005) revealed not only the field of education but also a comprehensive literature review on DEA over a 30-year period. As a result of the research, it has been concluded that the efficiency research conducted with DEA have increased in general over time. Johnes (2015) discussed how operations research have been applied to education.

There are basically two reasons for conducting this study. The first is that there is no study examining the research on efficiency in higher education in the research conducted so far. The second is on the methodology of the research conducted. In the research, it is seen that the analyses are generally carried out with a single method. However, in this study, research on efficiency in higher education will be examined with two comprehensive analyses, namely descriptive content analysis and bibliographic analysis that will cover the methodology of another research. In this way, it is aimed to provide more information to the researchers about the research that have been conducted, to have information about the research to be done on the efficiency, and to gain different perspectives about the new research. Another feature of this study that makes it different from other research is that the studies to be examined were conducted in the context of Türkiye. The reason for this is that the structure and characteristics of higher education are related to the conditions of each country, which is true for all levels of education. It is important to guide the researchers by examining the research conducted in a similar context and in a homogeneous structure. At the same time, this situation will enable to make international comparisons by conducting research on efficiency in higher education in different countries. Examining the research on the efficiency of higher education institutions in a country will enable us to reveal the gaps in the literature, to get an idea about the efficiency of higher education for researchers who will work on the same areas, and the previous studies to be compared with each other. Research that has been conducted partially support this view. When the research on the efficiency of higher education institutions are examined, it can be well understood that there are studies that examine the efficiency of higher education institutions in a certain country by comparing these institutions among themselves (Agasisti & Dal Bianco, 2009; Aybarç Bursalıoğlu & Selim, 2015; Brzezicki, 2020; Hu et al., 2009; Loganathan & Subrahmanya; Moreno et al., 2019; Salas-Velasco, 2020; Wang & Li, 2010). However, no research has yet been done at the international level that compares the studies conducted in terms of content and methodology. This study has the feature of being the first research to examine studies on the efficiency of higher education in a country. Therefore, the aim of this study is to examine the research on the efficiency of higher education in Türkiye. In this way, the general trend and direction of the research conducted will be introduced to the researchers both in terms of content and methodology, it will be shed light on new research to be conducted and will be made suggestions to researchers. Another aim of this study is to help

researchers plan their studies on efficiency in higher education in other countries by reviewing the literature background in terms of content and methodology. In accordance with this purpose, answers will be sought to the following two basic questions:

What is the bibliographic trend in research on efficiency in higher education?

What is the content and methodological trend in research on efficiency in higher education?

Method

Research Model

This research is mainly based on two methods. The first of these is bibliographic analysis, and the second is descriptive content analysis. Bibliographic analysis is a method of researching and making sense of scientific data, revealing cumulative scientific knowledge, advancing a field in unique and meaningful ways, and allowing scientists to see ahead by providing them with an overview of a subject (Donthu et al., 2021). The second method, descriptive content analysis, is a systematic study that aims to direct future research in this subject area by examining in-depth quantitative and qualitative research on a determined subject (Ültay et al., 2021). In this study, bibliographic analysis was used to reveal the year and publisher of the studies, the number and institution of the authors, and the type of publication. Descriptive content analysis, on the other hand, was used to reveal the content and methodological trends of the studies.

Data Collection

In the collection of data, firstly, the criteria for which studies to be included were determined by the researchers. The inclusion criteria were determined as the fact that the studies (1) were on higher education institutions, (2) were about efficiency, (3) examined higher education institutions in Türkiye, and (4) were empirical. Studies that did not meet all four criteria were excluded from the analysis. Web of Science, Scopus, EBSCO, ProQuest Dissertations and Theses Global, Google Scholar, Sobiad, National Thesis Center of the Council of Higher Education, TR Index databases were used to collect the data. The keywords “efficiency and education”, “efficiency and higher education”, “ efficiency and university” were used to access studies in these databases. These keywords were searched in the abstract and title sections of the databases. First of all, the abstract of the studies was reviewed by the researchers and the studies that were found suitable at first glance were recorded in the file. In this way, 80 studies were found. The second examination was again carried out by two researchers separately. Among these studies, a total of 10 studies were excluded from the analysis because 5 studies were on the efficiency of high schools, 1 research was on the efficiency of secondary schools, 2 studies were not on efficiency, and 2 studies were recorded in the literature file twice. Finally, 70 studies on efficiency in higher education were included in the analysis.

Data Coding

After obtaining the data from these studies, a coding list was created in line with the opinions of the authors of previous studies and of this study. The research were coded under the following headings: "(1) Year of research, (2) publisher, (3) number of authors, (4) author institution, (5) publication type, (6) keywords, (7) type of unit examined, (8) data analysis method, (9) number of methods used, (10) efficiency measurement model used, (11) data year, (12) analysis program, (13) number of units examined, (14) type of higher education examined, (15) duration of efficiency review, (16) data source, (17) used inputs, (18) number of inputs, (19) used outputs, (20) number of outputs, (21) purpose of the research." After this determined coding list, all research were coded by only one researcher, and the research were checked by the other researcher by comparing them with all codings. While coding the research, some data were not specified in the study, so they were entered as "unspecified" in the code list and they were excluded from the analysis. The coding list was finalized, and the data was prepared afterwards. While the first five codings of the obtained data are within the scope of bibliographic analysis, the remaining codings are within the scope of descriptive content analysis.

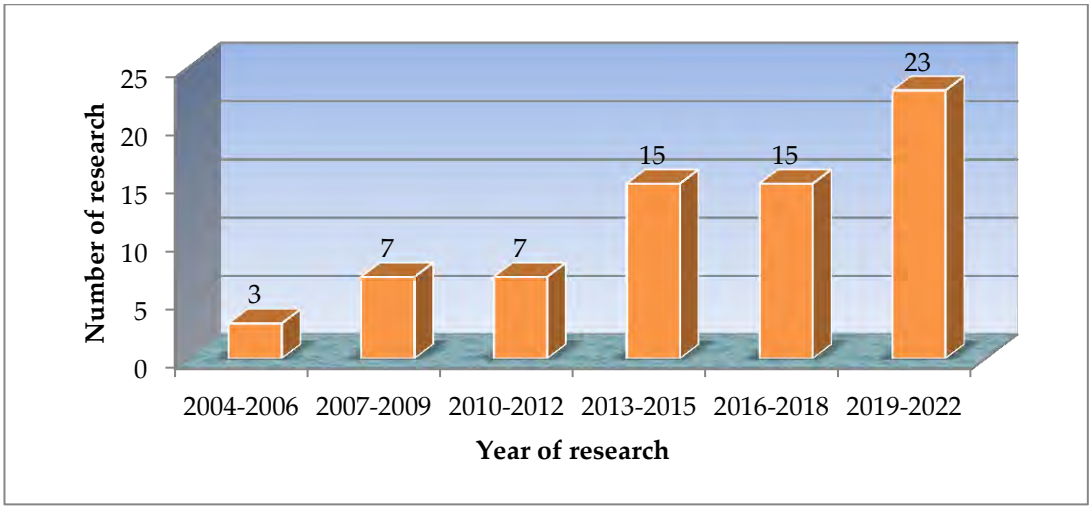
Results

The results of this study will be presented in two parts as findings based on bibliographic analysis and findings based on descriptive content analysis. In the presentation of the results, graphics were used in general, and tables were used where necessary due to the simplicity and clarity of visual reading.

Results Related to Bibliographic Analysis

Years of Research

The distribution of research on efficiency in higher education by years is given in Graph 1.

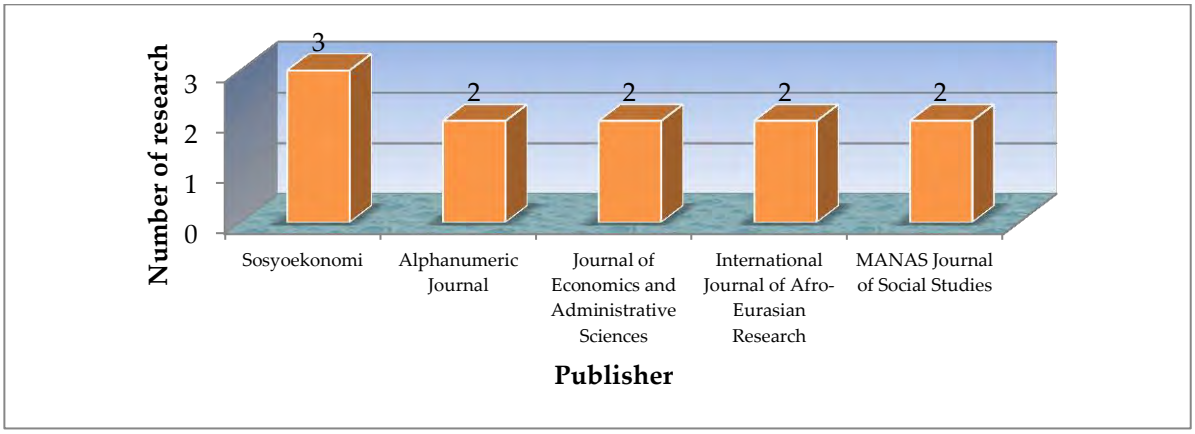


Graph 1. Distribution of research by years

When the distribution of the studies according to the years is examined, it is seen that the first study identified was conducted in 2004. It is seen that 3 of the 70 studies examined were between 2004-2006 (4.3%), 7 of them between 2007-2009 (10%), 7 of them between 2010-2012 (10%), 15 of them between 2013-2015 (21.4%), 15 of them between 2016-2018 (21.4%) and 23 of them between 2019-2022 (32.9%).

Publisher of Research

Publishers of research on effectiveness in higher education are given in Graph 2. The reviewed studies were published by 64 different publishers in total. However, since listing that would take up a lot of space, the five publishers with the highest number of publications are included here.

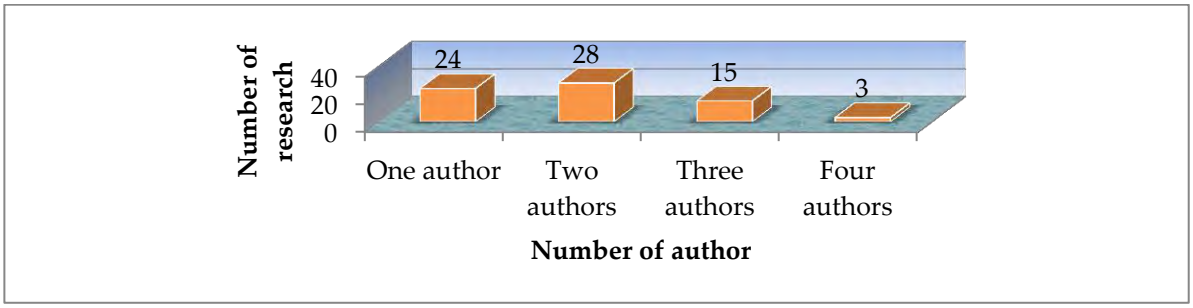


Graph 2. Distribution of research by publishers

A total of 70 published studies were published by 64 different publishers. That is, 1.09 publications per publisher. The publisher that published the most research is the journal "Sosyoekonomi". "Alphanumeric Journal", "Atatürk University Journal of Economics and Administrative Sciences", "International Journal of Afro-Eurasian Research" and "Manas Journal of Social Research" share the second place with two publications.

Number of Authors of Research

The number of authors of the research on efficiency in higher education is given in Graph 3. Research have been published with at least one author and at most four authors.

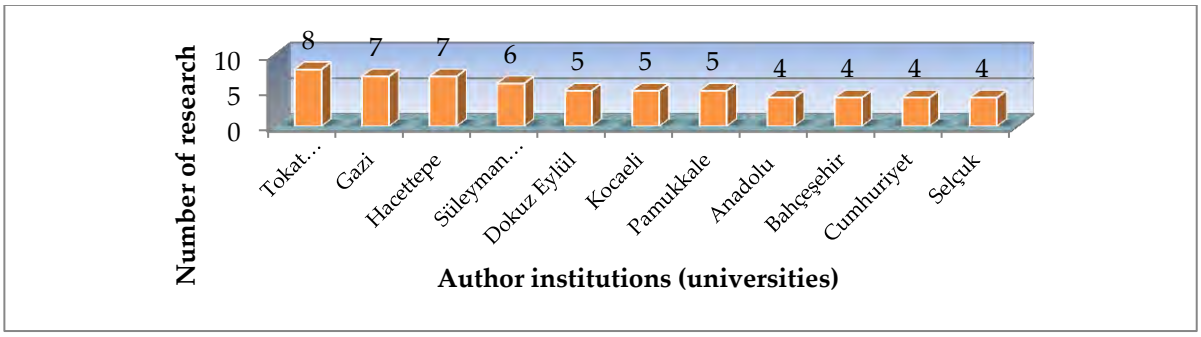


Graph 3. Distribution of research by number of authors

When Graph 3 is examined, it is seen that of the studies, 24 were written by one author (34,3%), 28 were written by two authors (40%), 15 were written by three authors (21,4%), and 3 were written by four authors (4,3%). It is seen that the research are published with at most two authors, and the majority of them with one and two authors. The lowest rate belongs to research with four authors.

Author Institutions

The institutions of authors of the research on efficiency in higher education are given in Graph 4. In total, 70 research were published by the authors from 62 different institutions. However, since listing all of them would again take up a lot of space, the ten publishers with the highest number of publications are included here.

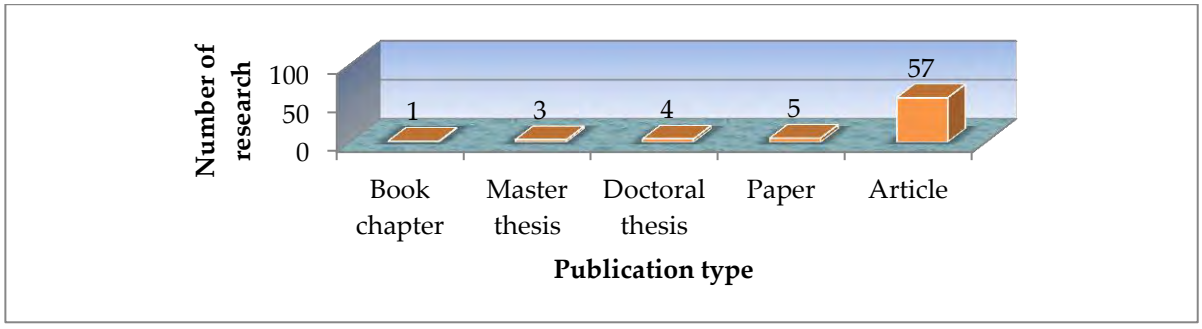


Graph 4. Distribution of research by author institutions

When Graph 4 is examined, it is seen that the authors contributing to the research are mostly from Tokat Gaziosmanpaşa University". It is seen that seven researchers each from Gazi University and Hacettepe University, six researchers from Süleyman Demirel University, five researchers each from Dokuz Eylül University, Kocaeli University and Pamukkale University, and four researchers each from Anadolu University, Bahçeşehir University, Cumhuriyet University and Selçuk University contributed to the research.

Publication Type

The distribution of studies on effectiveness in higher education by publication type is given in Graph 5.



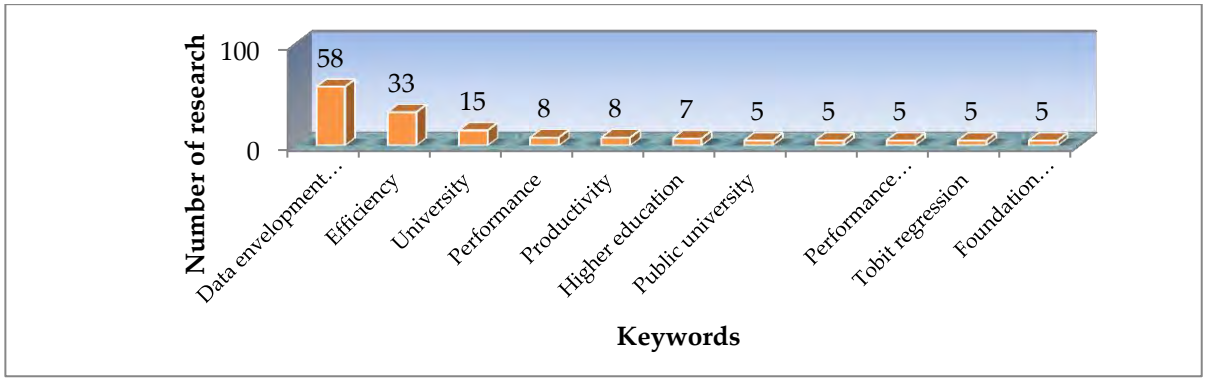
Graph 5. Distribution of research by publication type

When Graph 5 is examined, 57 of the research are articles (81.4%), 5 of them are papers (7.1%), 4 of them are doctoral thesis (5.7%), 3 of them are master's thesis (4.3%) and 1 of them is a book chapter (1.4%). Therefore, the type of research published the most were articles, and the least were book chapters.

Results for Descriptive Content Analysis

Keywords Used in Research

Keywords in a research are the basic notions that give an idea to the readers about that topic. The reason for analyzing the keywords in this research is to reveal the basic notions about efficiency in higher education and to enable the reader to see these notions. The distributions of the keywords used in the research on efficiency in higher education are given in Graph 6. However, not all keywords are included here as they would take up too much space, and 11 most frequently used keywords are included.

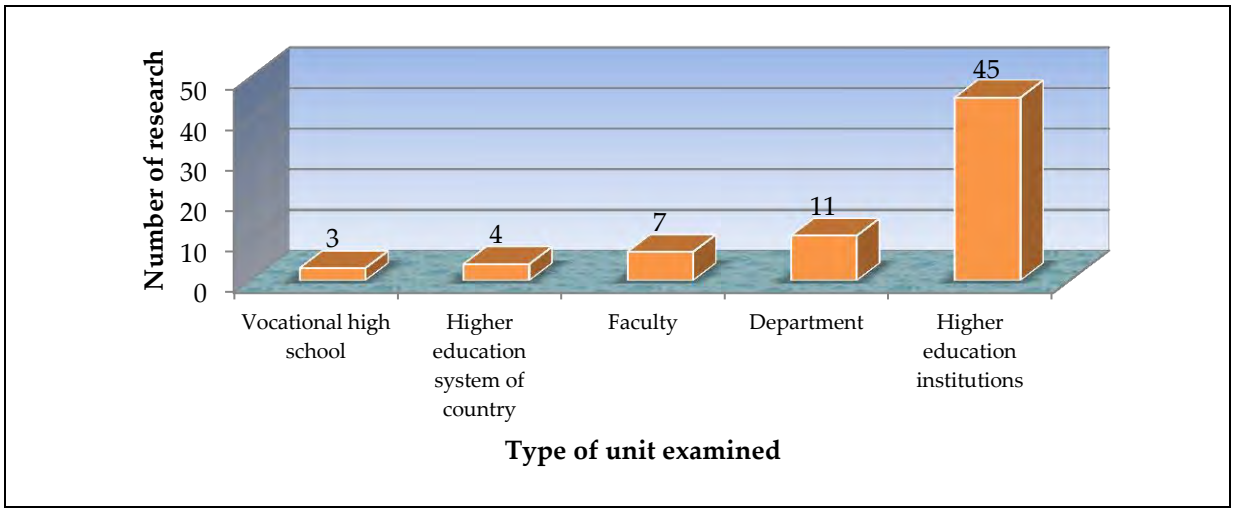


Graph 6. Distribution of keywords used in research

When Graph 6 is examined, it is seen that the most used keyword in these studies is *"data envelopment analysis"*. Then, it is seen that the notions of *"activity* and *university"* are used in high numbers.

Type of Unit Examined

The types of units whose efficiency were examined in the research on efficiency in higher education are given in Graph 7.



Graph 7. Distribution of unit types whose effectiveness was examined in research

When Graph 7 is examined, it is seen that the units whose efficiency were examined are divided into five different types. The most examined unit is higher education institutions (64.3%). Then, departments (15.7%), faculties (10%), higher education systems of countries (5.7%) and vocational high school (4.3%) were examined in order.

Data Analysis Method

The distribution of data analysis methods used in research on efficiency in higher education is given in Table 1.

Table 1. Data analysis methods used in research

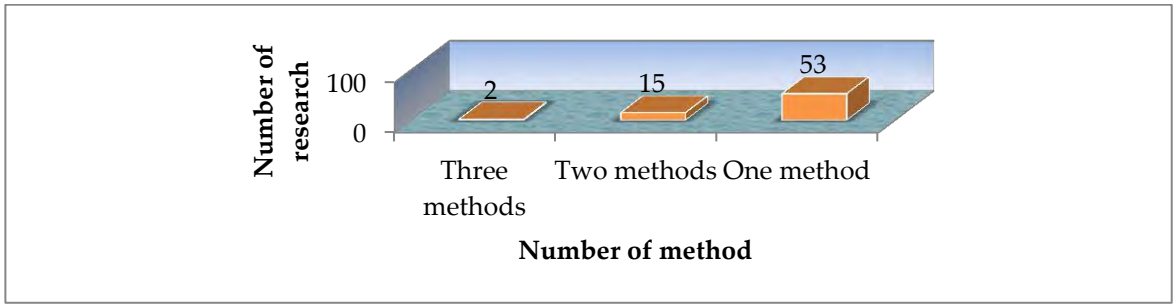
	Analysis Method	Number of research	Percent %
Efficiency measurement method	Data Envelopment Analysis	63	92,6
	Stochastic Frontier Analysis	2	2,9
	Data Envelopment Analysis and Stochastic Frontier Analysis	2	2,9
	Multi Stage Data Envelopment Analysis	1	1,5

Additional analysis methods	Tobit Regression	6	24
	Mann-Whitney U test	3	12
	Analytical Hierarchy Process (AHP)	3	12
	Kruskal Wallis Test	2	8
	Beta Regression	1	4
	Fuzzy Analytical Hierarchy Process	1	4
	EATWOS	1	4
	Kolmogorov-Smirnov test	1	4
	MACBETH	1	4
	Moses Test	1	4
	measure-specific DEA	1	4
	Promethee Method	1	4
	Super Efficiency Model	1	4
	TOPSIS	1	4
	Wilcoxon Signed Ranks Test	1	4
	Total	**93**	**100**
	Number of examined research	**70**	
	Number of methods per research	**1,32**	

It is seen that basically two main methods are used in research on the efficiency of higher education. Those in the first category are methods for efficiency measurement. These methods refer to the methods in the main focus of research. Those in the second category refer to other methods that are next to the first category. These methods are used to answer sub-research questions related to efficiency measurement rather than being used directly in efficiency measurement. When the efficiency measurement methods are evaluated within themselves, the most used method is data envelopment analysis (92.6%). Stochastic frontier analysis was used at a rate of 2.9%. In some studies, both data envelopment analysis and stochastic frontier analysis methods have been used together. The rate of these research is 2.9%. The multi-stage data envelopment analysis approach was used in only one research. Additional analysis methods are divided into 16 different methods. Among these, the most used method is Tobit Regression analysis (24%). It is followed by the Mann Whitney U test (12%) and the AHP approach (12%). 93 methods were used in a total of 70 research and the average number of methods per research was found to be 1.32.

Number of Methods

The distribution of the number of data analysis methods used in research on efficiency in higher education is given in Graph 8.

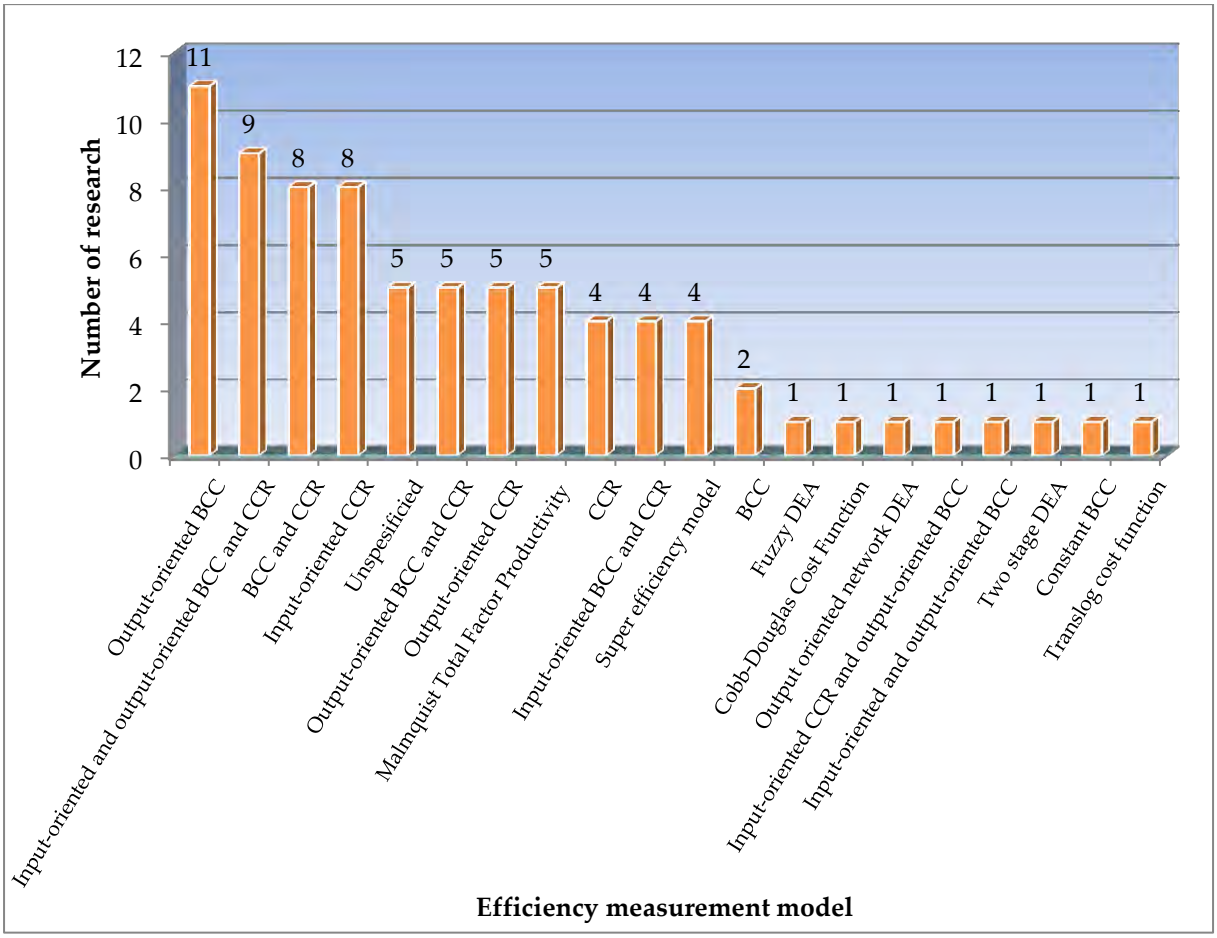


Graph 8. Distribution of the number of data analysis methods used in research

When Graph 8 is examined, it is seen that at least one and at most three methods are used together in studies on efficiency. In the analysis, the number of research using a method is 53 (%75,7), the number of research using two methods is 15 (21.4%), the number of studies using three methods together is 2 (2.9%).

Efficiency Measurement Models

The distribution of efficiency measurement models used in research on efficiency in higher education is given in Graph 9.

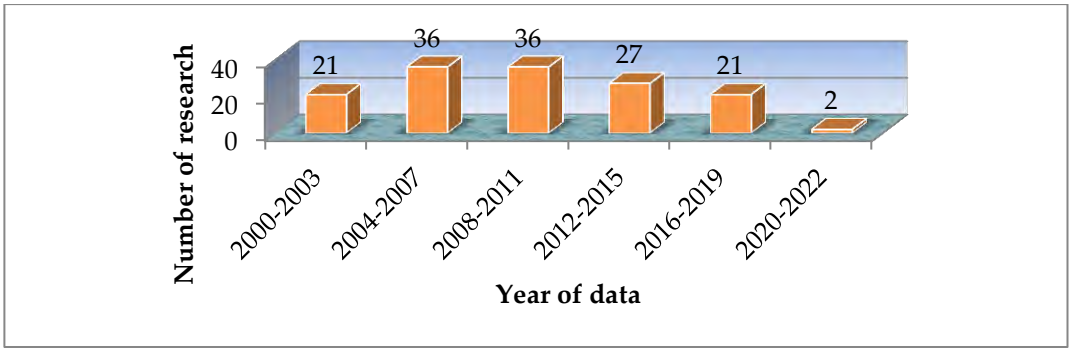


Graph 9. Distribution of efficiency measurement model used in research

When Graph 9 is examined, it is seen that 20 different efficiency measurement models are used in efficiency analysis in higher education. Among these models, the most used models are output-oriented BCC model (n=11, 14.1%), input-oriented and output-oriented BCC and CCR model (n=9, 11.5%), BCC and CCR model (n=8, 10.3%) input-oriented CCR model (n=8, 10.3%).

Year of Data

The distribution of the years to which the data used in the research on efficiency in higher education belong is given in Graph 10.

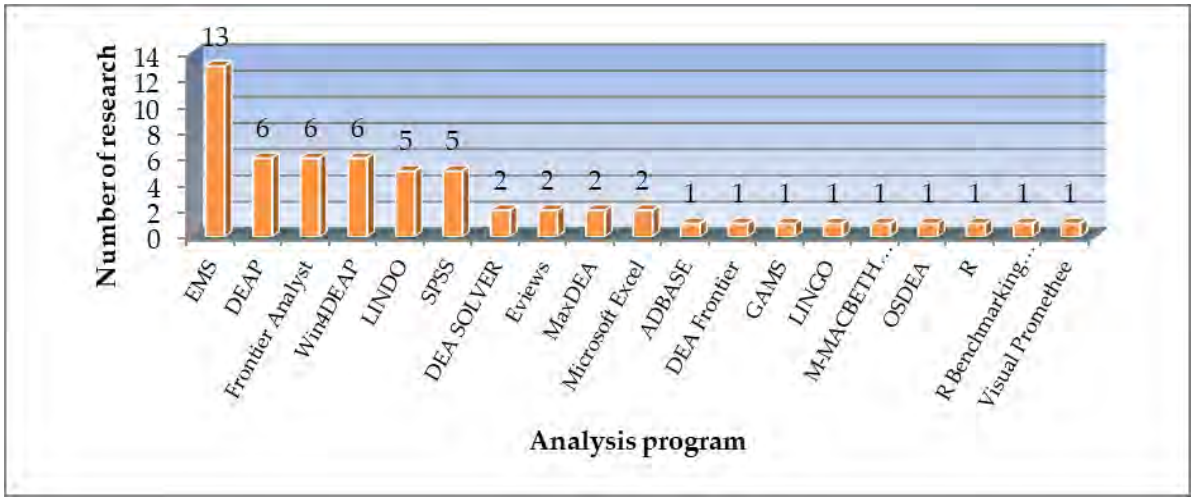


Graph 10. Distribution of the year of data used in the research

When Graph 10 is examined, it is seen that the data used in the research mostly belong to the years 2004-2007 (n=36, 25.2%) and 2008-2011 (n=36, 25.2%). The number of research with data used between 2000-2003 is 21 (14.7%), this number is, 27 (18.9%) for the years between 2012-2015, 21 (14.7%) for the years between 2016-2019 and 2 (1.4%) for the years between 2020-2022.

Efficiency Analysis Programs

The distribution of efficiency measurement models used in research on efficiency in higher education is given in Graphic 11.

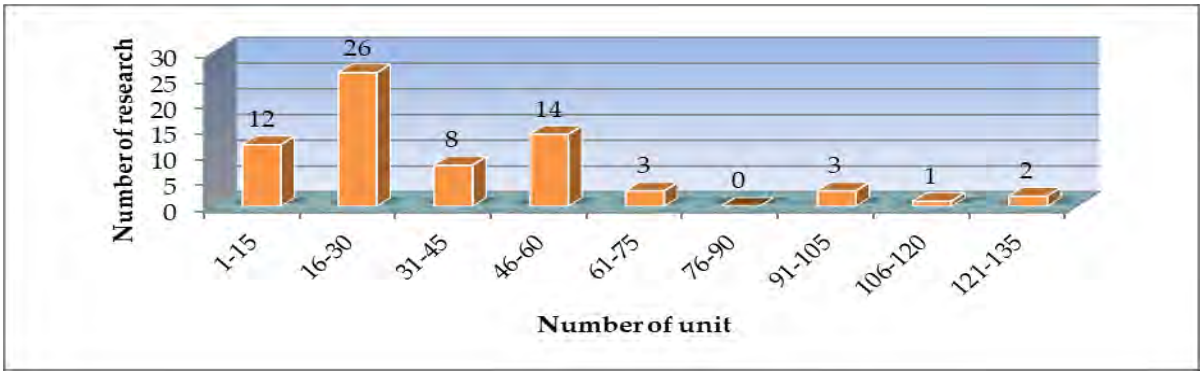


Graph 11. Distribution of analysis programs used in efficiency analysis

When Graph 11 is examined, it is seen that 19 different programs used in efficiency analyses have been identified. Among these programs, EMS is the most widely used program. While DEAP, Frontier Analyst and Win4DEAP programs are the second most used programs, LINDO and SPSS programs are in the third place.

Number of Units Examined

The distribution of the number of units examined in the research on efficiency in higher education is given in Graph 12.

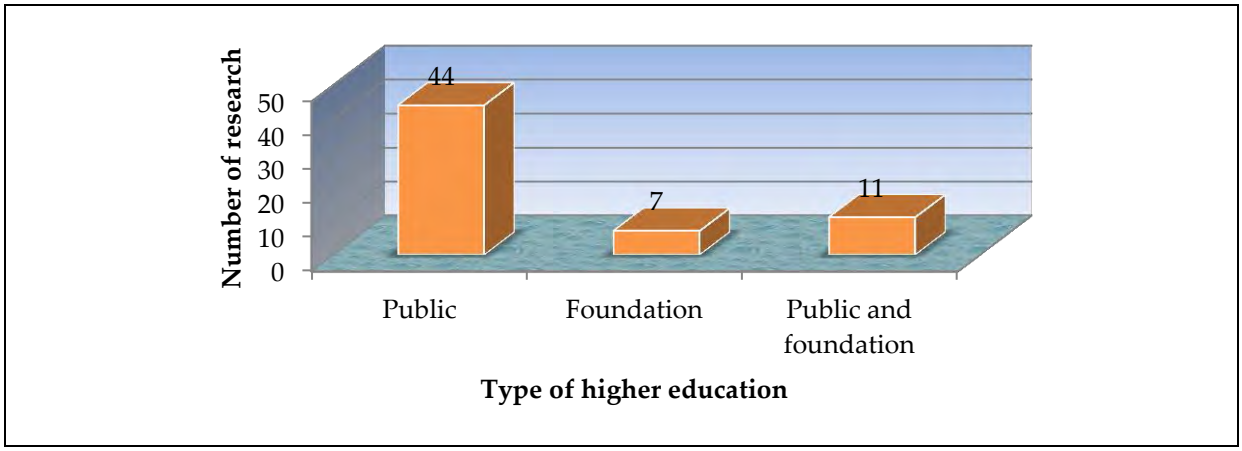


Graph 12. Distribution of the number of units examined in efficiency analyses

When Graph 12 is examined, the number of units examined between 1-15 in efficiency analyzes is 12 (17.4%), this number is, 26 (37.7%) between 16-30, 8 (11.6%) between 31-45, 14 (20.3%) between 46-60, 3 (4.3%) between 61-75, 3 (4.3%) between 91-105, 1 (1.5%) between 106-120, 2 (2.9%) between 121-135. In this case, the maximum number of units examined in research is in the range of 16-30 units. In more than half of the research, units in the range of 1-30 were examined.

Type of Higher Education

The distribution of the type of higher education examined in the research on efficiency in higher education is given in Graph 13.

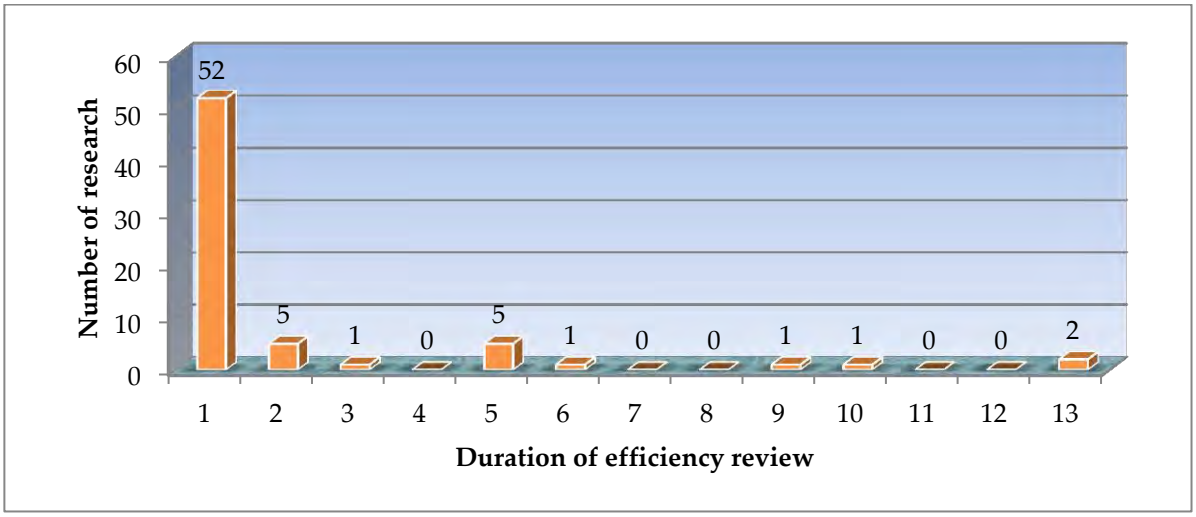


Graph 13. Distribution of the type of higher education examined

When Graph 13 is reviewed, it is seen that higher education institutions whose efficiency is analyzed are examined in three different ways. The first is the public higher education institutions and the second is foundation higher education institutions. In some research, the efficiency of both state and foundation higher education institutions has been examined together. The number of studies examining the effectiveness of state higher education institutions is 44 (71%), this number is, 7 (11.3%) for foundation higher education institutions, and 11 (17.7%) for state and foundation higher education institutions.

Duration of Efficiency Review

The distribution of the duration of efficiency review showing for how many years the units whose efficiency is examined in the research on efficiency in higher education are examined are given in Graph 14.



Graph 14. Distribution of the duration of efficiency review

When Graph 14 is reviewed, in 52 (76.5%) of the efficiency research, the efficiency of units has been examined on a one-year basis. The number of research reviewed for more than one year is 16 (23.5%). The number of research that were handled in a way to cover a time period of 2 and 5 years in the units whose efficiency was examined, is 5 each (%7,4); this number is, 1 research (1.5%) for 3, 6, 9, 10 years, and 2 research (3%) for 13 years.

Data Sources

The distribution of the sources of the data used in the research on efficiency in higher education is given in Table 2.

Table 2. The sources of the data used in the research

Data Source	Number of Research	Percent (%)
Council of Higher Education	37	25
University annual reports	17	11
Center for Assessment, Selection and Placement	12	8
The Scientific and Technological Research Institution	9	6
Ministry of Treasury and Finance	8	5
URAP	7	5
University interior units	7	5
Web of Science	6	4
Unspecified	6	4
Individual interview	5	3
OECD	4	3
University website	4	3
Survey	3	2
Ministry of National Education	2	1
University performance programs	2	1
University strategic plans	2	1
University database	2	1
Foundation higher education institutions report	2	1
Presidency of Strategy and Budget	2	1
Research article	1	1
Scientific book	1	1
General Directorate of Budget and Financial Control	1	1
State Planning Organization	1	1
Assessment	1	1
Econlit	1	1
EUROSTAT	1	1
Quality and Talent Management Association	1	1
Unofficial website	1	1
SCImago Journal & Country Rank	1	1
Scopus	1	1
Turkish Statistical Institute	1	1
Turkish Academic Network and Information Center	1	1

When Table 2 is examined, it is seen that 32 different data sources are used in the research. Among these data sources, the three most used data sources are the Council of Higher Education (n= 37, 25%), annual reports published by universities (n=17, 11%), and then data provided by the Center for Assessment, Selection and Placement (n=12, 8%). It is clear that the Council of Higher Education data is used more than other data sources.

Used Inputs

The distribution of the used inputs in research on efficiency in higher education is given in Table 3.

Table 3. Used inputs in the research

Category	Used Input	Input Frequency	Category Frequency	Category Percent
Numbers of Personnel	Number of academic personnel	21	121	41,2
	Number of academic members	19		
	Number of administrative personnel	12		
	Number of research assistants	11		
	Number of associate professors	9		
	Number of assistant professors	9		
	Number of professors	9		
	Number of instructors	7		
	Number of lecturers	7		
	Number of non-academic personnel	2		
	Number of lecturers and assistants	2		
	Number of research assistants and lecturers	1		
	Number of associate professor per department	1		
	Number of assistant professor per department	1		
	Number of lecturer per department	1		
	Number of professor per department	1		
	Number of other academician	1		
	Number of assistant	1		
	Number of academic personnel per student	1		
	Number of academic personnel excluding academic member	1		
	Number of professors and associate professors	1		
	Total number of professor, assistant professor and doctor lecturer	1		
	Number of academic member per program	1		
	Number of assistant lecturer	1		
Financial Resources	Budget	12	67	22,8
	Total expenditure	8		
	Expenses for the purchase of goods and services	7		
	Personnel expenses	5		
	Investment expenditure	4		
	Budget expenses	2		
	Education expenditure	2		
	Personnel expenses	2		
	Capital expenses	2		
	Transfer expenditures	2		
	Academic personnel salaries	1		
	Research infrastructure funding amount	1		
	Research funding and grants or project allocation	1		
	Extra-budgetary expenditure	1		
	Current expenditure	1		
	General expenditure	1		
	Capital expenditures for construction and maintenance	1		
	Labor price	1		
	Capital expenditures for the purchase of goods	1		
	Financial inputs	1		
	State spending per student	1		
	Education budget per academic member	1		
	Capital and labor expenses	1		
	Total financial resources	1		
	Total expenses	1		
	Total allowance	1		

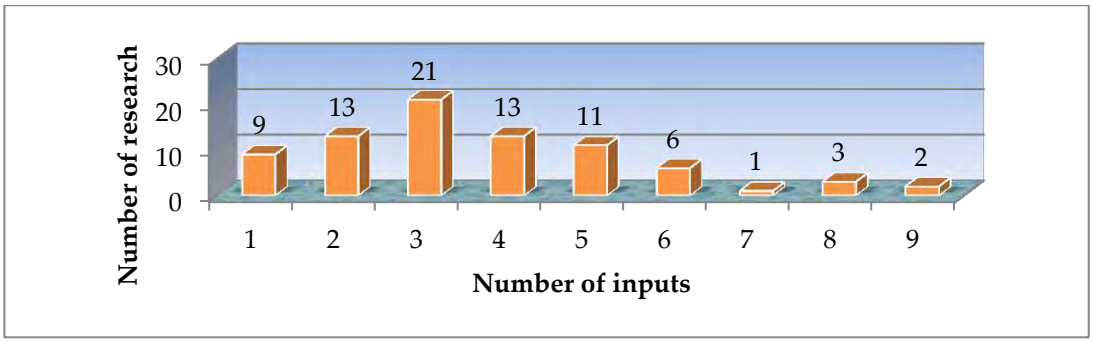
	Ratio of university revenues to annual budget	1		
	Annual expenses	1		
	Ratio of higher education expenditures in GDP	1		
	Ratio of higher education public expenditures to total public expenditures	1		
	Project budget	1		
Numbers of Students	Number of students	16	32	10,9
	Number of students per academic personnel	3		
	Number of students per instructor	2		
	Number of students per department	1		
	Number of students per physical area	1		
	Number of students per administrative personnel	1		
	Number of undergraduate students	1		
	Number of graduate students	1		
	Number of students per academic member	1		
	Number of undergraduate students per professor	1		
	Number of graduate students per professor	1		
	Number of PhD students	1		
	Number of students per assistant academic member	1		
	Ratio of students per teacher	1		
Other Inputs	Education and training	2	20	6,8
	Quality system development	2		
	Leadership	2		
	Assessment and evaluation	2		
	Personnel participation	2		
	Program design	2		
	Process control and improvement	2		
	Recognition and award	2		
	Vision	2		
	Education services	1		
	Constant value	1		
Physical Resources	Amount of enclosed space	7	19	6,5
	Number of computers	2		
	Number of library resources	2		
	Number of laboratories and conference halls	1		
	Education area per student	1		
	Social area per student	1		
	Number of computers belonging to students	1		
	Number of computers belonging to instructors	1		
	Number of research areas per academic member	1		
	The amount of technological resources	1		
	Total physical area	1		
Number of Units	Number of faculty	3	15	5,1
	Number of academic units	2		
	Number of classrooms	2		
	Number of institutes	2		
	Number of vocational high schools	2		
	Number of departments	1		
	Number of departments and programs	1		
	Number of faculties and colleges	1		
	Number of programs	1		
Research and Publication	Number of articles	2	9	3,1
	Number of AHCI articles	1		
	Number of SCI-E articles	1		
	Number of SSCI articles	1		
	Total number of publications	1		
	Number of publications	1		

	Number of publications per academic personnel	1		
	Number of projects	1		
Inputs for The Academic Department	Student entry point	2	7	2,4
	Student quota	2		
	Department base point	1		
	Undergraduate placement test point	1		
	The average of the base point in the department in the student selection exam	1		
Inputs for Lessons	Ratio of department course credits to total credits	1	4	1,4
	Number of courses in the department	1		
	Course credit total	1		
	Annual course hours	1		

When Table 3 is examined, it is seen that the outputs used in research on efficiency in higher education are divided into nine different categories. The first of these is the input related to the number of personnel. In this category, 24 different inputs were used 121 times in total. Its rate in the total usage is 41.2%. The second category is inputs related to financial resources. In this category, 31 different inputs were used 67 times in total. Its rate in the total usage is 22.8%. The third category is inputs related to the number of students. 14 different inputs in this category were used 32 times in total. Its rate in the total usage is 10.9%. The fourth category is other inputs. In this category, 20 different inputs were used 11 times in total. Its rate in the total usage is 6.8%. The fifth category is inputs related to physical resources. 11 different inputs in this category were used 19 times in total. Its rate in the total usage is 6.5%. The sixth category is inputs related to the number of units. 9 different inputs in this category were used 15 times in total. Its rate in the total usage is 5.1%. The eighth category is the inputs related to the academic department. 8 different inputs in this category were used 9 times in total. Its rate in the total usage is 3.1%. The ninth category is the inputs related to the courses. 4 different inputs in this category were used 4 times in total. Its ratio in the total usage is 1.4%.

Number of Inputs

The distribution of the number of inputs used in research on efficiency in higher education is given in Graph 15.



Graph 15. Distribution of the number of inputs used in research

When Graph 15 is examined, the number of research using one input is 9 (11.4%), the number of research using two inputs is 13 (16.5%), the number of research using three inputs is 21 (26.6%), and the number of research using four inputs is 13 (16.5%), the number of research using five inputs is 11 (14%), the number of research using six inputs is 6 (7.6%), and the number of research using eight inputs is 1 (1,3%), the number of research using nine inputs is 3 (3.8%), and the number of research using ten inputs is 2 (2.5%).

Used Outputs

The distribution of the sources of the data used in the research on efficiency in higher education is given in Table 4.

Table 4. Used outputs in the research

Category	Used Outputs	Output Frequency	Category Frequency	Category Percent
Student-oriented Outputs	Number of undergraduate students	15	101	37,7
	Number of postgraduate students	15		
	Number of students graduated	15		
	Number of PhD students	8		
	Number of master's degree student	8		
	Number of diplomaed graduate students	7		
	Number of students	7		
	Number of associate and undergraduate students	7		
	Number of diplomaed postgraduate students	6		
	Number of diplomaed PhD students	2		
	Number of diplomaed master's degree student	2		
	Graduation rate	2		
	Number of associate students	2		
	Ratio of diplomaed higher education to total population	2		
	Number of undergraduate registered students	1		
	Number of vocational college students	1		
	Number of students per academic member	1		
Outputs for Research, Project and Publication	Number of publications	29	95	35,4
	Number of projects	17		
	Number of citations	9		
	Number of international publications	9		
	Number of articles	3		
	Number of national publications	3		
	Number of national and international publications	2		
	Number of AHCI articles	1		
	Academic incentive score	1		
	Research performance	1		
	Citation rate	1		
	Number of printed books	1		
	Number of public and infrastructure projects supported	1		
	Number of supported projects	1		
	Number of educational, cultural and social activities	1		
	Intellectual property pool	1		

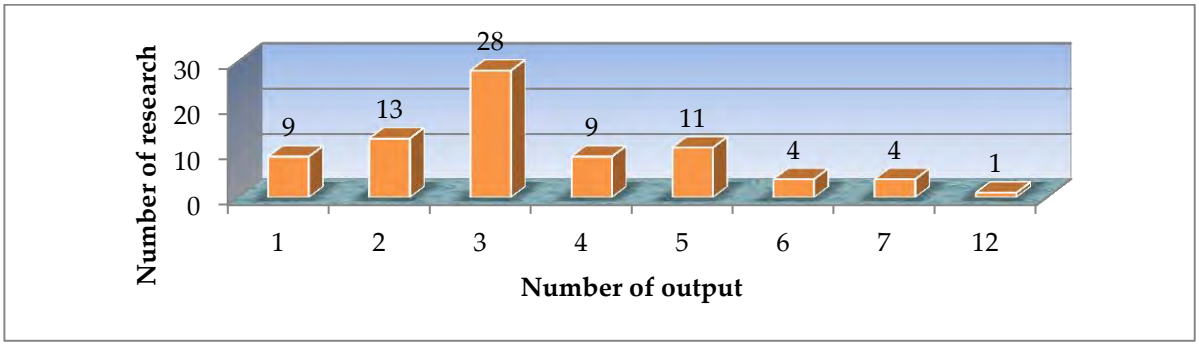
	Entrepreneurial and innovative university index score	1		
	H-index	1		
	Number of administrative activities, conferences and seminars	1		
	Article score	1		
	Number of national publications per lecturer	1		
	Number of international publications per lecturer	1		
	Number of proposed projects	1		
	Number of patents	1		
	Number of SCI-E articles	1		
	Number of SCI, SSCI and AHCI publications	1		
	Number of SSCI articles	1		
	Total number of scientific documents	1		
	Total number of articles	1		
	Number of articles abroad	1		
Financial Outputs	Project budget	5	24	9,0
	Total amount of fee	2		
	University revenues	2		
	Research fund	1		
	Research Grant	1		
	Ratio of research project revenues to total funds	1		
	Budget	1		
	Budget revenue	1		
	Other revenues	1		
	Education and training revenues	1		
	Economic contribution and commercialization	1		
	Actual budget revenues	1		
	Education budget per faculty member	1		
	own revenues	1		
	Project amount	1		
	Fund amount from projects	1		
	Total revenue	1		
	Total expenditure	1		
Outputs for Academic Achievement	Public Personnel Selection Examination (KPSS) labor economics and industrial relations exam score	1	21	7,8
	KPSS econometrics exam score	1		
	KPSS general culture exam score	1		
	KPSS general aptitude exam score	1		
	KPSS law exam score	1		
	KPSS economics exam score	1		
	KPSS statistics exam score	1		
	KPSS business exam score	1		
	KPSS public administration exam score	1		
	KPSS finance exam score	1		
	KPSS accounting exam score	1		
	KPSS average score	1		
	KPSS score	1		
	KPSS numerical average score	1		
	KPSS verbal average score	1		
	KPSS ranking	1		
	KPSS international relations exam score	1		
	KPSS-A score averages	1		
	KPSS-B score averages	1		
	PISA science scores	1		
	PISA math scores	1		

Individual-oriented Outputs	Employment rate	3	17	6,3
	University ranking score	3		
	Job satisfaction	2		
	Student satisfaction	2		
	Personnel satisfaction	2		
	Graduation GPA (grade point average)	2		
	Collaboration and interaction	1		
	Higher education employment index	1		
	Life satisfaction of individuals with higher education	1		
Outputs for Competency	Skill proficiency	1	5	1,86
	Knowledge proficiency	1		
	Scientific and technological research competence	1		
	Student/faculty qualification	1		
	Competency proficiency	1		
Outputs for Student Background	Average graduate admission test score	1	3	1,1
	Student's university choice	1		
	University entrance score	1		
Other Outputs	Extracurricular time rate	1	2	0,7
	Number of graduate programs	1		

When Table 4 is examined, it is seen that the outputs used in research on efficiency in higher education are divided into eight different categories. The first of these is the student-oriented outputs. 17 different outputs in this category have been used 101 times in total. Its rate in the total usage is 37.7%. The second category is outputs for research, projects and publications. 30 different outputs in this category have been used 95 times in total. Its rate in the total usage is 35.4%. The third category is financial outputs. 18 different outputs in this category have been used 24 times in total. Its rate in the total usage is 9%. The fourth category is outputs for academic achievement. 21 different outputs in this category have been used 21 times in total. Its rate in the total usage is 7.8%. The fifth category is individual-oriented outputs. 9 different outputs in this category have been used 17 times in total. Its ratio in the total usage is 6.3%. The sixth category is the outputs for competency. 5 different outputs in this category have been used 5 times in total. Its rate in the total usage is 1.86%. The seventh category is outputs for student background. 3 different outputs in this category have been used 3 times in total. Its rate in total usage is 1.1%. The eighth category is other outputs. 2 different outputs in this category have been used twice in total. Its rate in the total usage is 0.7%.

Number of Outputs

The distribution of the number of outputs used in research on efficiency in higher education is given in Graph 16.



Graph 16. The distribution of the number of outputs used in research

When the Graph 16 is examined, the number of research using one output is 9 (11.4%), the number of research using two outputs is 13 (16.5%), the number of research using three outputs is 28 (35.4%), and the number of research using four outputs is 9 (11.4%), the number of research using five outputs is 11 (14%), the number of research using six outputs is 4 (5.1%), the number of research using seven outputs is 4 (5.1%), and the number of research using twelve outputs is 1. (1.3%).

Purpose of Research

The findings for the purposes of the research on efficiency in higher education are given in Table 5.

Table 5. Findings for the purposes of the research

The Main Purpose of Research	Number of Research
To determine the efficiency of the departments	10
To determine the efficiency of higher education institutions	9
To determine the efficiency of state universities	7
Measuring the efficiency of the faculties	6
To determine the efficiency of foundation universities	5
To determine the efficiency of countries in higher education	3
To determine the efficiency of Vocational Colleges	3
To measure the efficiency of Research and Candidate Research Universities	2
To determine cost efficiency	2
To rank higher education institutions	2
To evaluate efficiency with weight-unrestricted and weight-restricted DEA	1
Evaluation of relative efficiency of academic units	1
To determine the efficiency of state universities established in the same period	1
To measure research, teaching and budgeting efficiency of state universities	1
To locate state universities and to analyse their performance	1
To determine the efficiency of quality management practices of state and foundation universities	1
To examine the efficiency level of Turkish universities in the top 500 in the world.	1
To determine the reference cluster that inactive universities can take as a reference	1
To identify the factors affecting the efficiency	1
To determine the teaching performances of faculties	1
To measure the efficiency of universities in the focus of entrepreneurship and innovation activities	1
To determine whether there is a difference between the efficiency levels according to the establishment periods	1
To measure the efficiency and performance of Turkish universities in terms of their	1

communication	
To measure the postgraduate education performance and scientific and technological research competence performance of state universities in Türkiye	1
To determine the total factor efficiency of countries in higher education	1
To determine the research performance of universities	1
To measure the general and educational performances of universities	1
To determine the entrepreneurial and academic efficiency of universities	1
To measure the efficiency of universities in the context of quality management practices	1
To analyze the performance of universities	1
To determine the technical and scale efficiency of universities	1
To measure the efficiency of the activities carried out by the universities within the scope of their third mission	1
To determine the efficiency of the number of students of foundation universities and the incomes of these universities	1
To determine the total, technical and scale efficiency of foundation universities	1
To determine the education and research efficiency of higher education institutions	1
To determine whether the physical areas of higher education institutions are used effectively	1

As a result of the analysis, 36 different research purposes were determined in the research on the efficiency of higher education institutions. When Table 5 is examined, it is seen that the purpose of 10 research (13.3%) is to evaluate the efficiency of the departments. The number of research aiming to determine the efficiency of higher education institutions is 9 (12%). The number of research aiming to determine the efficiency of state universities is 7 (9.3%). It was aimed to determine the efficiency of faculties in 6 research (8%), to determine the efficiency of foundation universities in 5 research (6.7%), to determine the higher education efficiency of countries in 3 research (4%), to determine the efficiency of vocational colleges in 3 research (4%), to determine the efficiency of research and candidate research universities in 2 research (4%), to determine the cost-efficiency in 2 research (2.7%), and to rank higher education institutions in 1 research (1.3%). Apart from these, efficiency analyses were carried out for different purposes in 26 different research.

Discussion

The purpose of this study, by examining the research on the efficiency of higher education, is to inform the researchers about the general tendency and direction of the research in terms of content and methodology, and to make recommendations to researchers about future research. For this purpose, a total of 70 research were analyzed with bibliographic and descriptive content analysis. As a result of the research, basically the following conclusions were reached:

First, it has been determined that research on efficiency in higher education has increased in general and this increase has accelerated in recent years. This result of the research is in parallel with the research of Rhaiem (2017) and Emrouznejad and Thanassoulis (2005).

Second, it is seen that there are many publishers that publish research on efficiency in higher education. One of the most important reasons for the occurrence of this situation can be shown as the

increase in the number of research on efficiency in higher education in recent years. Therefore, the number of alternative publishers that researchers can publish research on efficiency in higher education has also increased.

Third, it is seen that higher education institutions, namely universities, are mostly examined in the research. This result of the research is compatible with the research result of Rhaiem (2017). The reason for this can be thought of as the easier access to data for universities. However, it is seen that the number of especially interdepartmental, interfaculty, and intercountry comparative research is very low. Measuring the efficiency of the departments and faculties within the universities may enable the necessary steps to be taken regarding efficiency, by providing information to the university administration. In addition, there are research in the literature dealing with the comparisons between countries. This research are periodically examined by different researchers and reveal the level of activity of a country in a certain time period. This situation allows a country to have information about the level of its activities compared to other countries and to use this information in its policies. Therefore, researchers need to consider the efficiency of higher education more comparatively with other countries.

Fourth, it has been determined that data envelopment analysis, which is one of the non-parametric methods, is used more as an efficiency analysis method in the research conducted. This result of the research is in parallel with the research results of Rhaiem (2017). Rhaiem (2017) revealed that non-parametric tests are used more as an efficacy analysis method in his research. However, this research differed from other research and identified additional analysis methods used in research. The Tobit regression analysis method, which tries to determine the factors affecting the efficiency scores in the research, is the second most used analysis method. However, although it is used the most compared to other methods, its usage is very low. The reason why the Tobit regression model is less used in research is that the researchers did not aim to determine the factors affecting the efficiency. Because Tobit regression analysis is a test that aims to reveal the factors affecting the efficiency scores of decision-making units (DMU). In addition to ending the research by only determining the efficiency of DMUs in the research, determining the factors affecting these efficiency scores will add richness to the research. In addition, because of the efficiency analysis, it was concluded that multi-criteria decision-making methods were used for ranking purposes, as well as data envelopment analysis, which could not rank the efficient units alone. Efficient units with the methods such as especially AHP, fuzzy AHP, MACBETH, Promethee, TOPSIS, which are frequently used in the literature, are listed. However, the number of these research is quite limited. In addition, it was concluded that stochastic frontier analysis method, which is one of the parametric methods, is used in very few research, with DEA and SFA being used in fewer when together. The point that can be suggested to researchers here is that besides DEA, effectiveness analysis should be done with the

SFA method, and even the results should be compared by using both methods. In addition, it is important to use multi-criteria decision-making methods together with DEA, which cannot determine the ranking among the effective units alone, and for researchers to aim at the ranking of DMUs.

This result of the research is in fact directly related and compatible with the fifth result of this research. The fifth result of this research is the low number of methods used in the research. Only one method was used in more than three-quarters of the research. This is due to the limited number and narrow scope of the aims of the research. The most important indicator of this is that the rate of research using three methods is only 2%.

Sixth, it is seen that the output-oriented BCC model is the most preferred among the efficiency measurement models in research. There may be some reasons for this situation. The CCR model is a method used when the increase in outputs is proportional to the increase in inputs. The BCC model, on the other hand, is a method used when the increase in outputs is not proportional to the increase in inputs (Mikušová, 2017). The main difference between the two is that the BCC model calculates variable returns to scale by dividing technical efficiency into pure efficiency and scale efficiency. The CCR model is an approach that is more appropriate to be used when decision-making units operate at optimum scale (Kipesha & Msigwa, 2013). Since higher education institutions operate at different scales with different sizes, environments, locations and experiences, it can be considered that the BCC approach based on variable returns to scale is a more appropriate model. According to Cooper et al. (2007), if there are large numerical differences between the data of the decision-making units, the BCC model is a more appropriate method. Higher education institutions have many inputs such as increasing budget and personnel numbers over the years, and these inputs tend to increase in general. It seems more rational to examine the efficiency of higher education institutions, whose inputs tend to increase in general and continuously, by considering the maximization of their outputs rather than examining the efficiency of them based on decreasing their inputs. What is required from higher education institutions is not to produce a certain and fixed output by keeping the inputs at a minimum, but to maximize their output. Higher education institutions are expected to increase their output by allocating many resources (Gralka et al., 2019; Tone & Sahoo, 2003). Therefore, although there is no rule that output-oriented BCC should be strictly applied in the efficiency analysis of higher education institutions, it has been determined that this model tends to be used more in this research.

Seventh, while the number of studies on effectiveness in higher education is increasing every year, it has been concluded that more up-to-date data are not used in this direction. The reason for this situation to occur may be due to the difficulty of researchers in reaching up-to-date data. The use of old data while evaluating the current state of higher education institutions in future research jeopardizes the reliability of the current results of the research. It is important that researchers feel as a need to use up-to-date data as much as possible in future research.

Eighth, it has been concluded that there are many programs that can be used for efficiency analysis. With the development of technology, programs that can make analyzes that should be used in research with simpler calculations have emerged. Efficiency analysis is also included. As a result of the examination, it was determined that there were 19 different activity analysis programs. Therefore, this research shows researchers that there are many programs that can be used in efficiency analysis.

Ninth, it has been concluded that the number of units whose efficiency has been examined is low. The existence of a small number of units such as academic departments and faculties may be a logical explanation for the low number of DMUs whose efficiency has been examined. However, the number of universities in Türkiye is relatively high. Therefore, there is a clear need to carry out research in which more universities are included in the efficiency analysis in future research.

Tenth, it has been concluded that public universities tend to be examined more. The number of research in which foundation higher education institutions or foundation and state higher education institutions are examined together is low. Therefore, in future research, there is a need for research that examine both foundation higher education institutions within themselves and state and foundation higher education institutions together.

Eleventh, it has been concluded that the number of personnel, financial inputs, number of students, physical resources, and number of units represent almost the entire input set in the inputs used in the efficiency analysis in the research. One of the most important issues and problems in the efficiency analysis of higher education institutions is which inputs and outputs will be selected for analysis (Kipesha & Msigwa, 2013). There is no consensus among researchers on which inputs and outputs will be included for inputs, outputs, quality and environment in higher education, and modeling of the production process cost structure (Ferro & D'Elia, 2020). Witte and López-Torres (2017), in their research examining the efficiency literature in education, revealed that very different input and output sets are used in efficiency analyses. Therefore, it is not logical and possible to determine a single and standard input and output set for higher education institutions as well. This is because higher education can differ between countries and even between regions. Therefore, the most rational way is to include comprehensive and representative inputs and outputs in the analyses. Another result that emerged from this research is that the outputs used in the research are basically represented by four different outputs: students, research, project and publication, financial variables, and academic achievement. This result of the research is compatible with the research of Ferro and D'Elia (2020). In their research, Ferro and D'Elia (2020) concluded that alumni, publications and patents were used as the most used outputs. The conspicuous deficiency in the research examined by this research is that uncontrollable variables are not included in the analysis as input and output. Higher education institutions are institutions that affect and are affected by their environment. Therefore, inclusion of uncontrollable -environmental variables in the analysis will ensure that the

efficiency measurement is more comprehensive and reflective. In the literature, there are research in which efficiency analyses are made by including these variables. For example, variables such as the quality of teaching and research (De Witte & Rogge, 2011; Haelermans & Blank, 2012), the characteristics of the teacher such as age, gender, experience (Burney et al., 2013; Naper, 2010), the level of competition (Haelermans et al., 2012; Misra et al., 2012), the socio-economic structure of the region where the institution is located (Cordero et al., 2017; Deutsch et al., 2013) are called uncontrollable environmental variables that do not have direct intervention by the institution.

Twelfth, it has been concluded that three inputs and three outputs are generally used in research. This result is compatible with the conclusion that the number of examined units reached in this research is low. The lower the number of DMUs is, the lower the number of inputs and outputs is. Because, the number of inputs and outputs is too high compared to the number of decision-making units, it reduces the discrimination power of data envelopment analysis. In other words, using too many inputs and outputs according to the number of decision-making units makes it difficult for data envelopment analysis to determine the efficient units. The suggested basic rule is that the number of decision-making units should be at least twice the total number of inputs and outputs (Golany & Roll, 1989). On the other hand, Vassiloglou and Giokas (1990) state that data envelopment analysis works more powerfully when the number of decision-making units is more than twice the number of inputs and outputs. Banker et al. (1989), state that the number of decision-making units should be at least three times the number of inputs and outputs. Cook et al. (2014), state that these views are not a rule or an obligation and are not based on a statistical basis. All these views are stated for with the aim of convenience. Otherwise, it is possible for the data envelopment analysis to lose its distinguishing power.

Conclusion

There has been a significant increase in the number of studies on efficiency in higher education in the last 20 years. A significant part of the research has been carried out on universities. Although there are many efficiency measurement methods in the literature, the data envelopment analysis method is more preferred by the researchers. Data envelopment analysis can be performed with different models. Among these models, it is seen that the output-oriented BCC model comes to the fore. Inputs and outputs used in efficiency measurement may vary in different studies. However, the number of personnel, financial inputs, student numbers and physical resources are important representatives of inputs in different input sets. In addition, students are important representatives of research/project/publication, financial variables and academic achievement outputs. Finally, it has been concluded that the aim of the research is directed to different problems in the research on the efficiency analysis of higher education institutions, but the scope of the research can be improved. Although the main purpose of efficiency research in higher education is to determine the efficiency of

the units, both the selection of units and the methodological approach used differentiate the purpose of the research. While some research aim to determine the efficiency of public universities, others focus on a specific area of universities such as cost or research efficiency. The point to be emphasized here is that efficiency analysis of universities in a country or of universities, faculties, academic departments, institutes, and similar units in different countries can be done, as well as the efficiency analyses of these units in different fields can be focused on. For example, such as analysis of research efficiency of countries, analysis of cost-efficiency of universities, analysis of research efficiency of faculties. The issue that is ignored in the research is the efficiency analysis research for the dimension of service to society, which is called the third mission of higher education. Therefore, there is a need to take this dimension of higher education into account in future research.

Conflict of interest

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Ethical Statement

This research was ethically reviewed by Marmara University/Institute of Educational Sciences/Research and Publication Ethics Committee and was approved ethically with the approval number 06-4 on 31 August 2022.

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