A STUDY ON LOCATION SELECTION FOR PRIVATE DISABLED CARE CENTER USING AHP AND TOPSIS METHODS: THE CASE OF ISTANBUL PROVINCE

AHP VE TOPSIS YÖNTEMLERİ KULLANILARAK ÖZEL YATILI ENGELLİ BAKIM MERKEZİ YER SEÇİMİNE YÖNELİK BİR ÇALIŞMA: İSTANBUL İLİ ÖRNEĞİ

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Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi
Yıl: 2024 Cilt: 33 No: 1 Sayfa: 203-221
https://dergipark.org.tr/tr/pub/cusosbil

DOI: 10.35379/cusosbil.1306963

Geliş Recieved: **30.05.2023**
Kabul Accepted **05.02.2024**

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Anahtar Kelimeler:
Özel Engelli Bakım Merkezleri,
Yer Seçimi,
Çok Kriterli Karar Verme Yöntemleri

Keywords:
Private Disabled Care Centers,
Site Selection,
Multi-Criteria Decision-Making Methods

ABSTRACT

This study aims to determine the criteria to be considered during the site selection stage of private disabled care centers for disabled individuals, to list the criteria by weighting, and to choose the right place among alternative places. The research was designed in three stages. In the first stage, the articles published in WOS and SCOPUS were examined and criteria for site selection were determined. In the second stage, the criteria were presented to the expert opinion and weighted with the Analytical Hierarchy Process Method. In the third stage, the three identified alternatives were presented to the expert opinion again and the ranking of the alternatives was made with the TOPSIS method. With the analyzes made, it has been concluded that the most logical places among Kadıköy, Büyükçekmece, and Şişli districts are Büyükçekmece, Kadıköy, and Şişli, respectively. It is thought that the study will increase the quality of care services to be provided to individuals with disabilities and will be a guide for the private enterprise that is considering opening an institution in this field.

ÖZ

Bu çalışma; engelli bireyler için özel yatılı bakım merkezlerinin yer seçimi aşamasında dikkat edilmesi gereken kriterlerin belirlenmesi, kriterlerin ağırlıklandırılarak sıralanması ve alternatif yerler arasından en doğru yer seçiminin yapılmasını amaçlamaktadır. Araştırma deseni üç aşamalı olarak tasarlanmıştır. İlk aşamada WOS ve SCOPUS indekslerinde yayınlanmış makaleler incelenerek yer seçimine yönelik kriterler belirlenmiştir. İkinci aşamada kriterler uzman görüşüne sunulmuş ve Analitik Hiyerarşi Prosesi Yöntemi ile ağırlıklandırılmıştır. Üçüncü aşamada ise belirlenen üç alternatif tekrardan uzman görüşüne sunulmuş ve TOPSİS yöntemi ile alternatiflerin sıralaması yapılmıştır. Yapılan analizler ile Kadıköy, Büyükçekmece ve Şişli ilçeleri arasından en mantıklı yer seçiminin sırasıyla Büyükçekmece, Kadıköy ve Şişli olduğu sonucuna ulaşılmıştır. Çalışmanın engelli bireylere sunulacak bakım hizmetlerinin kalitesini artıracağı ve bu alanda kurum açmayı düşünen özel teşebbüs için yol gösterici bir nitelik taşıyacağı düşünülmektedir.

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Alıntılamak için/Cite as: Demir Uslu Y, Artan T. Aygün S. Özkan A. ve Oğuz T. (2024). A study on location selection for private disabled care center using ahp and topsis methods: the case of ıstanbul province. Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 203-221

INTRODUCTION

Today, the number of disabled people in need of care is increasing gradually with the prolongation of the average life expectancy as a result of the developing technology. When the data of the World Health Organization is examined, it is seen that more than one billion people in the world have some form of disability and this number corresponds to approximately 15% of the world's population (WHO, 2020). In Türkiye, it is known that the rate of the disabled population is 6.9% in the report prepared by the T.C. Ministry of Family and Social Services (Engelli ve Yaşlı Hizmetleri Genel Müdürlüğü, 2021). When considered in this direction, it can easily be stated that the population of disabled individuals is quite high today and that these individuals may need care services in the coming years. Along with the increase in the number of disabled individuals in need of care, the services to be provided to these individuals are becoming more and more important day by day. In the World Report on Disability prepared by WHO, the services needed by individuals with disabilities; include services such as general health care, rehabilitation, aid and support, accessible environment, education and employment. (WHO, 2021). Disabled care, which comes to the forefront as one of these services, is of great importance for disabled individuals to continue their lives in a state of well-being. As a matter of fact, from past to present, it is known that many institutions operate to address the care needs of individuals with mentally disabled. (Donovan et al., 2013; Mechanic & McAlpine, 2000; Rahman et al., 2013; Shepherd et al., 1996; Wilson & Kouzi, 1990).

It is seen that the institutions operating in the name of the care of disabled people in Türkiye mainly compose of private sector organizations and public institutions. Private care centers, Hope Houses and Care, Rehabilitation and Family Counseling Centers affiliated to the General Directorate, which operate under the Republic of Türkiye Ministry of Family and Social Services General Directorate of Services for the Disabled and Elderly, are among these institutions. (T.C. Aile ve Sosyal Hizmetler Bakanlığı, 2022). In line with the information on the official website of the Ministry, it can be stated that there are 296 private care centers, 147 Hope Houses, and 135 Care, Rehabilitation, and Family Counseling Centers operating in the name of the boarding care of the disabled in different provinces, and they provide care services to the individuals with different types of disabilities (T.C. Aile ve Sosyal Hizmetler Bakanlığı, 2022). When the opening purposes of these centers are examined, it is seen that they are social service centers that can be opened by official institutions or organizations, real persons or private law legal entities, providing in-patient or day-to-day services for the care of persons with disabilities (T.C. Aile ve Sosyal Hizmetler Bakanlığı, 2012; T.C. Aile ve Sosyal Hizmetler Bakanlığı, 2010). At the same time, the opening and operation of the centers are based on specific legislation, and the characteristics of the places where these institutions will be opened are emphasized within the framework of the legislation to provide the best possible in-patient or day-care services for disabled individuals. As a matter of fact, "Regulation on Official Institutions and Organizations Care Centers for the Disabled People" and "Regulation on Special Care Centers for Disabled Individuals" are very important references in this context. Regulation on Special Care Centers for Disabled Persons, titled "The location and environmental conditions of the center.'' Boarding or daycare centers of Regulation on Special Care Centers for Disabled Persons- titled "The location and environmental conditions of the center''- to be opened in the 6th article, it is mentioned that it can be opened in places that do not have noise and air pollution, that are far from industrial establishments that have the potential to adversely affect human health and all kinds of non-sanitary institutions, that are convenient for transportation and are located in public living areas and have landscaping. At the same time, it is expected that the place where the central building is located will offer a suitable and safe environment for the arrival and departure of people with disabilities, considering the traffic. In addition, there is no establishment selling or storing explosives and flammable materials in the immediate vicinity of the building, and if there is, it is required to take measures in accordance with the relevant fire regulations (T.C. Aile ve Sosyal Hizmetler Bakanlığı, 2012). As seen in the relevant regulation, some legal criteria such as location and environment gain importance

in the process of choosing a place for the establishment of institutions that will provide care services for disabled individuals. However, it is considered very important to provide a scientific basis for all processes and to benefit from the scientific knowledge in the literature in order to minimize or completely eliminate the possible risks and errors for the ideal location selection for an institution planned to be opened by considering the superior benefit of the disabled individuals who will benefit from the care service. When the literature on such centers is examined, it is seen that many studies have been carried out, but the stage of site selection remains untouched compared to other topics. However, choosing the right place directly contributes to the investors of the private disabled care centers, the relatives of the disabled individuals, the transportation of the disabled individuals to the institution, the services provided in the institution for the disabled individuals, the speed of response in emergency situations, and many processes in terms of physical and mental aspects. Considering these situations, the fact that there hasn't been any study on the location of private disabled care centers in the literature constitutes the problem of the research. This study was designed within the framework of the research problem and was carried out in order to determine the criteria to be considered during the site selection stage of the disabled care centers, to list the criteria by weighting them in terms of importance, and to choose the most suitable and correct place among the alternative places by considering these criteria and their weights.

LITERATURE REVIEW

There haven't been any direct studies in the literature on the location of institutions providing private disabled care services in the field of social work. For this reason, the literature review on the subject was carried out by considering two different main points: first, the studies on the institutions that provide residential care services to disabled people and the points they focus on, and secondly, the studies on the selection of places and the subjects they focus on.

It is observed that the studies carried out on institutions providing private disabled care services to persons with disabilities generally deal with similar issues. As a matter of fact, it is seen that the majority of the studies focus on the personnel working in institutions operating at the point of providing residential care services for the disabled individuals and the subjects such as the physical or mental difficulties faced by these personnel and their burnout levels. (Acker, 2012; Disabilities & 2012, 2012; Kozak et al., 2013; Lahana et al., 2017; Lin et al., 2013.; Skirrow et al., 2007; Smyth et al., 2015; Weinberg et al., 1983), client violence to which they are exposed (Hensel et al., 2011; Kiely et al., 1998), corporate affiliation and job satisfaction levels (Deveau et al., 2016; Smyth et al., 2015). Apart from these studies, it is seen that there are also studies that study the housing of disabled people, which focuses on the quality of life of the clients and their satisfaction with their living conditions (Franklin et al., 2018; Lehman et al., 1991; Mares et al., 2002). In institutions that provide residential care services, it is seen that there are studies that emphasize the quality of the care environment and the care service offered to these individuals and evaluate the training of the personnel providing services for the disabled individuals (Donovan et al., 2013; Rahman et al., 2013; Shepherd et al., 1996; Wilson & Kouzi, 1990). In addition to such studies, which are frequently included in the literature, the existence of studies dealing with the number of personnel in institutions providing services to disabled individuals, the capacities of these institutions, the admission policies of disabled individuals to institutions, the therapy, models and approaches used in providing services to disabled individuals is noteworthy (Emond, 2003; Kommer, 2002; Leedahl et al., 2015; Lelliott et al., 1996; Söderback et al., 2004). There are also studies that focus on the emergence of the concept of institutionalization in the context of institutions providing services to disabled individuals, examine the profiles of clients receiving services from private disabled care centers, and focus on the process of making the decision to place them in residential care, and emphasize the potential of voluntary organizations to assume responsibility in care activities, although they are limited in number compared to other topics mentioned. It is possible to say that it takes place in the literature (Burke et al., 2012; Chow & Priebe, 2013; Mansell et al., 2002; Mechanic & McAlpine, 2000;

Read & Harrison, 2002; Xie et al., 2014).

The literature review on site selection was carried out by taking into account the studies conducted for private disabled care centers and health institutions that show similarities and parallels in terms of the services they provide and the characteristics of the services. Especially in recent years, it has been seen that many studies have been carried out on the selection of health institutions in this regard. It has been observed that in most of the studies, multi-criteria decision-making methods are used. In this context, when the national and international literature is scanned, it has been determined that the most direct hospital location selection is the focus point (Chatterjee & Mukherjee, 2013; Dell'Ovo et al., 2018; Rahimi et al., 2017; Şahin et al., 2019; SEN, 2017; Tripathi et al., 2021; Zandi & Delavar, 2021). In addition, studies that focus on location and construction area (Eldemir & Onden, 2016; Jalaliyoon et al., 2015; Yu et al., 2023), and studies that focus on population density and infrastructure (Kmail et al., 2017; Kumar et al., 2016; Sharmin & Neema, 2013; Vahidnia et al., 2009) and studies that focus on medical resources and cost, are also frequently examined in the relevant literature (Nsaif et al., 2020; Rezayee, 2020; Soltani & Marandi, 2011). At the same time, it has been found that there are studies that focus on the quality of service provided and select the location (Adalı & Tus, 2019; Senvar et al., 2016) along with the study that makes site selection by taking into account the preferences of citizens (Samani & Alesheikh, 2019), the study that chooses a location by considering social health insurance and competition situations (Chiu & Tsai, 2013), and the studies that choose a location by determining the focal point of disaster management (Moradian et al. al., 2017; 2018; Liu et al., 2022).

The literature on site selection of private disabled care centers which is the main objective of the study, has been summarized both in terms of institutions providing residential care services for disabled people and in terms of site selection studies. As a result of the review, it has been found out that there are many studies focusing on institutions providing private disabled care services. In addition, it has been observed that there are also studies on site selection in the literature. It is evident that Multi-Criteria Decision Making methods are frequently used in site selection studies. However, in the literature review, no studies on the location selection of private disabled care centers have been observed, which establishes the originality of the study.

DATA AND METHODOLOGY

The research was designed to establish a boarding center for the disabled in three different regions in Istanbul, and to select the most appropriate one by using the multi-criteria decision-making methods AHP and TOPSIS. The research design includes the evaluation of seven main criteria, which were determined by reference to previous studies in the literature, by experts with at least 7 years of experience in the field, and the selection of the most appropriate place in line with this evaluation.

The research focuses on the selection of the most appropriate location for the establishment of an institution providing private residential care services for disabled people among alternative locations. Since there was more than one alternative in the research problem, multi-criteria decision-making methods were used. AHP and TOPSIS methods were utilized for the research solution. There are some reasons for this situation. These reasons can be identified as follows.

AHP analysis was preferred in this study due to its ability to express structural relationships, its convenience for binary comparisons, its prevalence in research and literature, and its ability to integrate multiple criteria. In the application phase of the research, TOPSIS method was used in the study to select one of the three available alternatives, taking into account its features of focusing on perfect and bad solutions, weighting, expressing ideal and anti-ideal solutions, ranking, general and effortless applicability.

Research Criteria

Table 1: Information about Criteria

Criteria Names	Explanations	References
Criterion 1 (C1): Transport	Transport: Public transport facilities, accessibility	Adalı & Tuş, 2019; Chiu & Tsai, 2013; Dell'Ovo et al., 2018; Eldemir & Onden, 2016; Kumar et al., 2016; Rahimi et al., 2017; Şahin et al., 2019; Senvar et al., 2016; Soltani & Marandi, 2011
Criterion 2 (C2): Geographical location	Geographical location: Proximity to the natural environment, air pollution, proximity to existing infrastructures, distance to other institutions, the safe environment around the institution, proximity to health institutions, proximity to relevant sectors	Chatterjee & Mukherjee, 2013; Dell'Ovo et al., 2018; Kaveh et al., 2020; Şahin et al., 2019; Samani & Alesheikh, 2019; Tripathi et al., 2021; Vahidnia et al., 2009
Criterion 3 (C3): Size of the Area	Allowing future growth and providing opportunities for social activity	Chatterjee & Mukherjee, 2013; Chiu & Tsai, 2013; Dell'Ovo et al., 2018; Rahimi et al., 2017; Senvar et al., 2016; Soltani & Marandi, 2011
Criterion 4 (C4): Physical condition	Interior architecture of the building, soil structure, earthquake resistance, underground resources, smooth ground	Adalı & Tuş, 2019; Chatterjee & Mukherjee, 2013; Senvar et al., 2016; Soltani & Marandi, 2011
Criterion 5 (C5): Socio-demographic characteristics	Disabled population density, education level, income status, socio-economic level	Adalı & Tuş, 2019; Chatterjee & Mukherjee, 2013; Dell'Ovo et al., 2018; Kaveh et al., 2020; Kumar et al., 2016; Rahimi et al., 2017; Şahin et al., 2019; Senvar et al., 2016; Soltani & Marandi, 2011; Tripathi et al., 2021; Vahidnia et al., 2009
Criterion 6 (C6): Cost	Land cost, building cost, zoning cost, ownership status	Adalı & Tuş, 2019; Chatterjee & Mukherjee, 2013; Chiu & Tsai, 2013; Dell'Ovo et al., 2018; Kumar et al., 2016; Senvar et al., 2016; Soltani & Marandi, 2011; Tripathi et al., 2021; Vahidnia et al., 2009
Criterion 7 (C7): Government policies	Policies such as incentives, taxes and legislation that encourage or restrict the opening of institutions.	Adalı & Tuş, 2019; Ajaj et al., 2019; Şahin et al., 2019; Soltani & Marandi, 2011

Selection of Alternative Locations

In order to identify alternative locations, interviews were held with officials working within the municipalities of Kadıköy, Büyükçekmece, and Şişli, which researchers currently have easy access to, and who dominate the real estate sector within the boundaries of the municipality. Considering the seven criteria determined within the study, these officials were asked to submit alternative places for rent. Authorities have determined alternative places within the boundaries of the municipality where they work and are available for rent. Information on the alternative places identified is presented in Table 2.

Expert Selection

For the evaluation of the criteria determined in the study with the AHP method, the opinions of four different experts were obtained separately. In the selection of specialists, the criteria of having at least 7 years of experience in the field and having a decision-making position in the relevant field (Ministry of Family and Social Services, Provincial Health Directorates, private disabled care centers, universities, etc.) were determined. After the completion of the AHP process, the non-numerical criteria (C1, C2, C4, C5, C7) were quantified by the same experts by scoring between 1-5 (Very Effective: 1, Effective: 2, Normally Effective: 3, Less Effective: 2, Ineffective: 5) in order to evaluate the 3 alternative regions by TOPSIS method.

Table 2. Information on Alternative Locations

	Alternative Place in Kadıköy	Alternative Place in Büyükçekmece	Alternative Place in Şişli
Rent	78 thousand TL per month	350 thousand TL per month	150 thousand TL per month
Category	Workplace	Workplace	Workplace
Status	For rent	For rent	For rent
Type	The Complete Building	The Complete Building	The Complete Building
Total m2	240 m2 open area,		
550 m^2 closed area	30.000 m^2 open area, 6.000 m^2 closed area	5.000 m^2 closed area	
Building Features	Elevator, security camera, generator, water tank, waterproofing, fire alarm, and fire escape are available.	Generator, water tank, garden, air conditioner, and fire alarm are available.	Water tank, garden, and fire escape are available.
Proximity	Mosque, market, hospital, health center, restaurant, church, and public transportation are available in close proximity.	Public transport, mosque, market, and hospital are nearby	Public transport, mosque, market, and hospital are nearby.

Table 3. Experts' Information

	Experience (Institution)	Experience (years)	Level of education
Expert 1	University	17	Associate professor
Expert 2	Private Disabled Care Center	15	License
Expert 3	Private Disabled Care Center	7	License
Expert 4	Private Disabled Care Center	10	License

Assessment Tools and Procedures

1. Data Collection Tools

In the research, data were collected in two different stages. In the first stage, the data were obtained as a result of the evaluations taken from experts with various characteristics. At this stage, the experts were informed about the research by the researcher about the assessment tools and assessment style in order to obtain the correct assessment. In the second stage, the data were obtained from the characteristics of three different regions subject to site selection. In this process, data expressing the required features of the relevant regions within the framework of seven main criteria were collected. While collecting the data, the owner of the land, the municipalities, the relevant ministries, and the organizations providing the transportation of the municipalities were used.

2. Analysis of Data

In the study, the data were analyzed in two stages. In the first stage, experts evaluated seven main criteria, which were determined by reference to previous studies in the literature. Evaluation includes the degree of importance of each criterion against other criteria. The data obtained from the experts were analyzed with AHP, one of the multi-criteria decision-making methods. General information about the AHP analysis and process is as follows:

2.1. AHP

The AHP method, which is one of the multi-criteria decision-making methods, was first developed by Saaty and defined as an important approach used in the selection and prioritization of multi-criteria decision-making problems or criteria (Saaty, 1980, 1986).

In the priority determination process of the criteria with the AHP method; The opinions of experts who meet certain conditions related to the relevant subject are taken. The data obtained in line with the feedback received from the experts are analyzed with the AHP method. As a result of the analysis, it is aimed to rank the predetermined criteria in order of importance. In this way, it will be determined which of the criteria has priority and which one should be given more attention and care.

The implementation stages of the method consist of 6 steps (Dağdeviren et al., 2001):

Step 1: Determining the criteria and their sub-criteria in line with the purpose of the decision-maker and creating a hierarchical structure

Step 2: Comparing the alternatives for each criterion and comparing the criteria among themselves (The Significance Scale given in Table 5 was used to make this comparison)

The binary decision matrix is as follows.

$$A = \begin{bmatrix} 1 & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} = 1/a_{1n} & \cdots & 1 \end{bmatrix} \quad (1)$$

Step 3: Performing normalization of relationship matrices

Each value in the matrix is normalized by dividing by its column sum.

$$a'_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}, i, j = 1,2, \dots, n \quad (2)$$

Step 4: Multiplying the importance weights of the criteria with the importance weights of the alternatives and finding the priority value of each alternative

The sum of each row of the normalized matrix is divided by the size of the matrix and averaged. These values are the importance weights calculated for each criterion. These weights establish the priority vector.

$$w_i = \left(\frac{1}{n}\right) \sum_{i=1}^{n} a'_{ij'} \quad i, j = 1, 2, \cdots, n \quad (3)$$

equation is used. Thus, percentage importance distributions showing the importance values of the criteria relative to each other are obtained.

Step 5: Performing a consistency analysis

The consistency ratio is expressed by the CI coefficient.

$$CI = \frac{\text{A max} - \text{n}}{\text{n} - 1} \quad (4)$$

$$\lambda max = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{\sum_{j=1}^{n} a_{ij}w_j}{w_i}\right) \quad (5)$$

$$AxW = \begin{bmatrix} 1 & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} = 1/a_{1n} & \cdots & 1 \end{bmatrix} x \begin{bmatrix} w_1 \\ \vdots \\ w_n \end{bmatrix} = \begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix} \quad (6)$$

$$d_i = \frac{x_i}{w_i}, \qquad i = 1,2 \cdots 1^n \quad (7)$$

$$\lambda_{max} = \frac{\sum_{i=1}^{n} d_i}{n} \quad (8)$$

In order to evaluate the consistency ratio, the RI value needs to be known. RI values are also given below.

Table 4: RI Value

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.53	1.56	1.57	1.59

After calculating the CI and RI values, the consistency ratio is calculated

$$CR = \frac{\mathrm{CI}}{Rı} \quad (9)$$

If the CR value is less than 0.10, it can be said to be consistent.

Step 6: Obtaining the overall scores of the alternatives

Table 5. Severity Scale

Importance level	Definition
1	Equally important
3	Moderately important
5	Strongly important
7	Quite strongly important
9	Definitely important

In the AHP analysis, the order of importance of the criteria evaluated and scored by the experts was determined.

In the second stage, analysis was carried out to select the most suitable one from three different regions. In the analysis in this process, data collected from various institutions were analyzed representing seven main criteria. TOPSIS, one of the multi-criteria decision-making methods, was used during the analysis. Of the seven criteria evaluated in the TOPSIS analysis process, only C6 has a minimum direction. The other six criteria were evaluated as maximum directional. In the analysis process, the minimum directionality of the cost criterion was taken into consideration. The points taken into consideration while evaluating the criteria are as follows:

C1: It is considered as a positive situation due to the high number of transportation opportunities.

C2: It is considered as a positive situation in terms of factors such as geographical location, use of infrastructure facilities, closeness to health institutions and fresh air environment.

C3: The size of the area is considered as a positive situation in terms of the possibility of social activities and opportunities for growth in the future. The size of the area was obtained from data collected from municipalities and relevant ministries. The size of the area was evaluated on the basis of total m2 without making any distinction between indoor and outdoor areas.

C4: The physical condition is considered as a positive situation in view of the features of the business architecture and soil structure of the building being appropriate for disabled people.

C5: Socio-demographic characteristics are considered as a positive situation in terms of establishing private residential care services for disabled people, taking into account factors such as income level, education level, and population of disabled people.

C6: The high cost is considered as a negative situation in the process of establishing an institution.

C7: Government policies are considered as a positive situation in terms of encouragement and support in the process of establishing an institution.

General information about TOPSIS analysis and process is as follows:

2.2. TOPSIS

TOPSIS method is one of the multi-criteria decision-making methods. Considering the determined criteria, it enables the best choice among the decision alternatives and the ranking of these alternatives (Özüdoğru & Görener, 2018). TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) was developed by Hwang and Yoon in 1981.

While ranking with the TOPSIS method, the alternatives that can take place in the first place are expected to be close to the ideal solution when it is also expected to be far from the non-ideal (negative ideal) solution. In other words, in the TOPSIS method, it is aimed to choose the one closest to the ideal solution and the one farthest from the negative ideal solution among the alternatives.

The implementation stages of the method consist of 6 steps (Özdemir, 2015):

Step 1: Creating the decision matrix

An n x m dimensional decision matrix is shown below.

$$D=\begin{bmatrix} d_{11} & d_{12} & \dots & d_{1m} \\ d_{21} & d_{22} & \dots & d_{2m} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ d_{n1} & d_{n2} & \dots & d_{nm} \end{bmatrix} \quad (1)$$

Step 2: Obtaining the normalized matrix

The normalized decision matrix is as follows.

$$R=\begin{bmatrix} r_{11} & r_{12} & \dots & r_{1m} \\ r_{21} & r_{22} & \dots & r_{2m} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ r_{n1} & r_{n2} & \dots & r_{nm} \end{bmatrix} \quad (2)$$

The elements of the normalized decision matrix *R* are calculated as follows

$$r_{ij}=\begin{cases} \dfrac{d_{ij}}{\sqrt{\sum_{k=1}^{n} d_{kj}}}, & i=1,2,\dots,n \ , \quad j=1,2,\dots,m \\ 0, & d.y. \end{cases} \quad (3)$$

Step 3: Obtaining the weighted normalized matrix

First, the weight values (Wi , i=1,2,...,m) for the evaluation criteria are determined.

Here $\sum_{i=1}^{m} w_i = 1$ The elements of the R matrix are multiplied by their respective weight values to form a weighted standard decision matrix, V

$$V=\begin{bmatrix} w_1r_{11} & w_2r_{12} & \dots & w_mr_{1m} \\ w_1r_{21} & w_2r_{22} & \dots & w_mr_{2m} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ w_1r_{n1} & w_2r_{n2} & \dots & w_mr_{nm} \end{bmatrix}=\begin{bmatrix} v_{11} & v_{12} & \dots & v_{1m} \\ v_{21} & v_{22} & \dots & v_{2m} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ v_{n1} & v_{n2} & \dots & v_{nm} \end{bmatrix} \quad (4)$$

Step 4: Obtaining the ideal and negative ideal solution values

Here, the positive ideal solution set is defined as $V^*=\{v_1^*, v_2^*, \dots, v_m^*\}$ and the negative ideal solution set as $V^- =\{v_1^-, v_2^-, \dots, v_m^-\}$

Step 5: Obtaining the distance values from the ideal and negative ideal points

The distance values to the positive and negative ideal solutions are obtained as follows.

$$S_i^*= \sqrt{\sum_{j=1}^{m}\left(v_{ij}-v_j^*\right)^2} \ , \quad \text{i=1,2,…,n} \quad (5)$$

$$S_i^-= \sqrt{\sum_{j=1}^{m}\left(v_{ij}-v_j^-\right)^2} \ , \quad \text{i=1,2,…,n} \quad (6)$$

Step 6: Calculating the relative closeness to the ideal solution

$$C_i^* = \frac{S_i^-}{S_i^* + S_i^-} \ , \quad \text{i=1,2,…,n} \quad (7)$$

equation is used to calculate the relative closeness values for each decision option. Here $0 \leq C_i^* \leq 1$, i=1,2,…,n. Equation (7) is the share of the distance to the negative ideal solution in the total distance. Accordingly, C_i^* i=1,2,…,n decision options close to 1 are preferred primarily.

When the previous studies were examined, it was seen that the non-numerical criteria were quantified by scoring between 1-5 by the experts (Adalı & Tuş, 2019; Supçiller et al., 2011). In this framework, the non-numerical transportation, geographical location, physical condition, sociodemographic characteristics, and government policy criteria of the study were digitized by scoring between 1-5 for four different experts, and the size of the area and cost criteria were added, and the analysis results obtained by the TOPSIS method and the AHP method were taken into account. It was ensured that the most suitable one from three different regions was chosen at the point of selection of a special boarding center for the disabled.

RESEARCH FINDINGS

The AHP method was used to obtain the weights of the selection criteria. Microsoft Excel program was used for the implementation of the AHP method. The goal here is to create pairwise comparison matrices. While creating the pairwise comparison matrices, the answers given by the experts who had predetermined criteria when comparing each criterion with the other were processed into the matrix. The inconsistency rates of expert judgments were controlled while obtaining the criterion importance levels. If the expert's inconsistency ratios are greater than 0.1, the judgments need to be revised. In this study, the inconsistency rate was found to be CR: 0.059, and the study was found to be consistent. In Table 6, the criteria weights obtained by the AHP method of 7 criteria in the selection of a private disabled care center are shown.

As a result of the AHP analysis, government policies (25%), physical condition (22%), and cost (16%) were determined as the most important criteria in the selection of a private disabled care center, respectively, and sociodemographic characteristics (4%) were determined as the least important criteria.

Table 6. Criterion Weights

Criteria	Criterion Weights (W)	Rankings
C1: Transport	0.0912	6
C2: Geographical Location	0.1255	4
C3: Size of the Area (Square Km, Acres)	0.1142	5
C4: Physical Condition	0.2179	2
C5: Sociodemographic Characteristics	0.0418	7
C6: Cost (Thousand TL)	0.1640	3
C7: Government Policies	0.2450	1

In the decision matrix created for the TOPSIS analysis, the decision alternatives consist of Kadıköy, Büyükçekmece, and Şişli districts of Istanbul. In the process of creating the TOPSIS decision matrix, the opinions of 4 experts were obtained separately and the average scores of these experts formed the final decision matrix. The criteria are transportation, geographical location, size of the area, physical condition, sociodemographic characteristics, cost, and government policies, which are weighted in the first stage (Table 7).

As a result of the TOPSIS analysis, the distance values to the ideal and negative ideal points were calculated. These obtained values and the relative distance values from the ideal solution were calculated (1) and the distances of all these values from the ideal solution are shown in Table 8.

As a result of the ranking made according to the Ci* values obtained from the distance to the ideal points and the distances to the negative ideal points, the alternative with the best condition in terms of the determined criteria was determined (Table 9).

According to the results of the TOPSIS analysis, the most suitable alternative among the 3 districts of Istanbul for the selection of a private disabled care center was determined as A2: Büyükçekmece, A1: Kadıköy, and A3: Şişli, respectively.

Table 7. TOPSIS Decision Matrix

Alternatives	C1: Transport	C2: Geographical Location	C3: Size of the Area (Square Km, Acres)	C4: Physical Condition	C5: Sociodemographic Characteristics	C6: Cost (Thousand TL)	C7: Government Policies
A1 (Kadıköy)	4	4	1	3	4	78	3
A2 (B. Çekmece)	3	4	6	5	3	350	5
A3 (Şişli)	4	3	5	4	4	150	2

Table 8. Distances to Ideal Points

Distances to Ideal Points	Si* Positive Ideal Distances	Si- Negative Ideal Distances
A1: Kadıköy	0.124037414	0.124077119
A2: B. Çekmece	0.115892117	0.155269163
A3: Şişli	0.12918515	0.109742251

Table 9: Results of TOPSIS Analysis and Ranking of Alternatives

Alternatives	Cİ*	Rankings
A1: (Kadıköy)	0.500080013	2
A2: (B. Çekmece)	0.572608166	1
A3: (Şişli)	0.45931212	3

DISCUSSION AND CONCLUSION

In this study; It is aimed to determine the criteria that should be considered during the site selection stage of the private disabled care centers that will provide services for the disabled, to rank the determined criteria by weighting in terms of importance, and to choose the most suitable and correct place among the alternative places by considering these criteria and their weights. For this purpose, among three different regions within the borders of Istanbul province, the most suitable region for the establishment of a private disabled care center was chosen using the AHP and TOPSIS methods, which are among the multi-criteria decision-making methods. In this direction, seven main criteria were determined by examining the previous studies on the subject in the literature. These criteria were evaluated by experts with at least 7 years of experience in the field of disability, and the most suitable place was chosen among the regions determined. The discussion part of the study was created by making use of the research carried out on the site selection of health facilities since there is no previous study on the site selection of private disabled care center in the literature.

In the study Sahin et al. (2019) using AHP and focusing on hospital location selection, demand factors were considered the most important criteria by experts, while accessibility, competitors' status, government policies, related sector, and environmental conditions were other important criteria, respectively (Şahin et al., 2019). In a study conducted by Adalı and Tus (2021) for hospital site selection using TOPSIS, EDAS, and CEDAS methods and in which experts evaluated eight different criteria, the most important criterion was market conditions (need for a new hospital), and cost (land and construction) took the second place and in the third place, transportation (access to the hospital) criterion is seen. These criteria are, in order of importance, geological factors (disaster risk such as earthquake and fault line), land strategy (strategy related to land in the future, such as expansion, parking, etc.), the financial support offered by the government, environmental assessment (water, noise, and air pollution) and demographic assessment (current and future population). (Adalı & Tuş, 2019). In another study conducted by Senvar et al. (2016) on hospital location selection, it was seen that the most important criterion was evaluated as market conditions, the second criterion was determined as accessibility in terms of public transportation, and the third most important criterion was a business strategy. These criteria are followed by cost, building structure, employees, and demographic characteristics, respectively (Senvar et al., 2016).

In a study conducted in India by Kumar et al. (2016) on hospital location selection, the most important criterion found by experts is proximity (proximity to the target population, proximity to other hospitals, proximity to social centers, etc.), followed by population characteristics (education, community structure, health awareness, etc.), two different criteria, human resources and cost, share the third place, and in addition, accessibility and environmental criteria are determined respectively (Kumar et al., 2016). In another study conducted in Iran by Rahimi et al. (2017) on the choice of hospital location, it is seen that proximity to main roads is determined as the most important criterion, population density is in the second place, and proximity to fire stations is in the third place. It was revealed that these criteria were followed by land characteristics, accessibility, and suitability (being close to the airport, not being in the river bed, and being far from industrial centers) (Rahimi et al., 2017). When the studies in the literature are examined, it is seen that there are common criteria in the studies carried out, especially in the name of hospital location selection, and similar results are reported with the findings of this study (Tripathi et al., 2021; Vahidnia et al., 2009). As a matter of fact, the research findings have revealed that the criteria of government policies are in the first place, the criteria of physical condition are in the second place, and the cost criteria are in the third place, according to the degree of importance at the point of location selection of the inpatient care centers. Other criteria following the first three criteria are geographical location, size of the area, transportation, and sociodemographic characteristics, respectively. It is noteworthy that, unlike other studies, the criteria of government policies have been evaluated as the most important criterion for the location selection of private disabled care centers. At this point, it is thought that different principles and practices such as incentives

provided by the government in Türkiye, tax reductions, and opening conditions in the legislation are effective. Similarly, it can be interpreted that the fact that the physical condition criterion is considered the second important criterion is due to the reference made to the physical conditions of the building and the land in the legislation regarding the establishment of the institution (T.C. Aile ve Sosyal Hizmetler Bakanlığı, 2012).

The findings obtained in the study reveal that Büyükçekmece, Kadıköy, and Şişli regions are preferred by experts for the private disabled care center, respectively. As a matter of fact, according to the March 2022 data of the institutions belonging to the General Directorate of Disabled and Elderly Services of the Ministry of Family and Social Services, it is seen that 16 (34.78%) of the 46 private disabled care centers within the borders of Istanbul are located in the Büyükçekmece region (T.C. Aile ve Sosyal Hizmetler Bakanlığı, 2022). This indicates that the research findings are compatible with current data.

In this research, in which the criteria for the location selection of the private disabled care centers in Türkiye are weighted according to the degree of importance, and the most suitable location is tried to be selected among the alternative places by considering these criteria; in terms of importance, it has been seen that the criteria are government policies, physical condition, cost, geographical location, size of the area, transportation, and sociodemographic characteristics, respectively. In the site selection process, it was revealed that Büyükçekmece was the most suitable location for the opening of a private disabled care center, Kadıköy was in second place and Şişli was in third place.

It is believed that the results of the research will make an important contribution to the academics who would like to work in this field and will be a guide for entrepreneurs or public institutions and organizations who are considering opening a private disabled care center. It would be an appropriate approach for future research to include different alternative places in the evaluation process and to focus not only on private disabled care centers but also on different social service institutions and organizations.

Limitations of the Research

When the data on the website of the General Directorate of Disabled and Elderly Services of the Ministry of Family and Social Services are examined at the point of selection of alternative places, it is seen that 16 of the 44 private disabled care centers operating under the ministry are in Büyükçekmece (36.36%), and 8 are in Beylikdüzü (18.18%),and 6 of them (13.63%) are within the boundaries of Arnavutköy district and these districts are in the first three rankings in terms of the number of institutions. (T.C. Aile ve Sosyal Hizmetler Bakanlığı, 2022). In this research, Şişli and Kadıköy districts were discussed within the scope of the research within the framework of the possibilities of the researchers in terms of reaching the municipal authorities. This situation constitutes an important limitation of the research.

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Author Contributions

All the authors have equal contributions.