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**RESEARCH ARTICLE**

# Determining Significant Factors Influencing the Choices of International Students with Spherical Fuzzy DEMATEL

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**Abstract**

Studying abroad has increasingly become prestigious in the world and its causes and effects are significant. In this study, we aimed to determine which factors are the most important for international students in choosing a country in which to study. In this respect, seven factors have been identified and analyzed with spherical fuzzy DEMATEL. The most important contribution of this study to the literature is that we analyzed it with numerical variables and a multi-criteria decision-making method based on non-numerical data and expert opinions. Thus, we aimed to guide policymakers and researchers. According to the study results, the most important factor for international students in choosing a country in which to study is legal and political factors. Therefore, it is crucial that countries provide attractive government policies and implement legal regulations Also, it is important to make legal systems more democratic. In addition, taking the necessary security precautions regarding routes to school and places where international students live, ensuring stress-free visa procedures, and simplifying legal requirements will encourage more international students to pick the country. In this way, economic and social development of the country will be facilitated.

**Keywords**

International education, International student, Choice factors, DEMATEL, Spherical fuzzy

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## Introduction

International education and its causes and effects is a topic discussed in the literature, and many factors and their effects are investigated. Studying abroad seems to be an important opportunity for students for who want to experience acculturation, better education, and career development (Ahmad & Shah, 2018). Some factors determine the definition of the international student. The first is going out of the country, the other is the period specified in the international student legislation in the destination country. In a broader sense, the international student is defined as a person who was born and grew up with a particular culture, lifestyle, and worldview and who leaves his or her family, environment, and country to receive education at more than one level, leaving the borders of his or her country and residing in another country for the period determined by the international student legislation of that country. Being an international student has its advantages and disadvantages. However, its advantages are more prominent, and hosting international students has important potential for a host country. International students make many contributions, particularly economically, to the countries they go to. Hence, attracting students to the country and retaining them is of vital importance. Therefore, we focused on determining which factors are the most important ones among international students' choice factors.

In this study, we aimed to investigate the choice factors of the increasing number of international students. The number of international students shows a serious increase in recent years. Particularly, it is seen that certain countries are at the top of the preferences, and there is a delicate balance that forces the rankings. The expectations for the future make qualified brain drain important. First, an extensive literature review was conducted in this study. Then, the criteria influencing factors in international students' choices were identified and analyzed by taking experienced experts' opinions into account. This study has some novelties. The theoretical contribution is that there are limited studies associated with multi-criteria decision-making methods in the literature. When the literature is reviewed, it is seen that in general, regression and cointegration analysis have been used in research on international students. (Chelleraj et al., 2008; Misra & Castillo, 2004). In a vast amount of studies, econometric models have been performed due to the inability to use non-numerical data. So this is disadvantageous for international students. Non-numerical parts of this study are analyzed together using spherical fuzzy DEMATEL, a multi-criteria

decision-making method, and by asking for experts' opinions with both numerical and non-numerical variables. Thus, it will be possible to provide more realistic and specific recommendations for relevant policy makers.

DEMATEL differs from other methods in some points. It is significant in terms of seeing the criteria that affect each other and giving the cause-and-effect relationship between them more comprehensively. Today, problem-solving techniques have become more complicated. Therefore, more detailed problem-solving techniques are required, and thus more detailed perspectives. In this case, we used SF-fuzzy instead of classic fuzzy. The method applied is the latest and current method that converts language expressions into statistics as closely as possible to real life while asking for expert opinions. SF-fuzzy method enables the problem to be handled more comprehensively by considering membership, non-membership, and hesitancy. Thus, this method helps to analyze the topic in a more detailed way. Furthermore, strategies obtained through this study will contribute to the social and economic development of countries by making it possible to make more effective policies.

This paper has four parts. The introductory part presents the literature review. In the second part, there is a literature review, which makes up a substantial part of this study. Subsequently, the methodology is explained, and practical applications are provided in detail. Lastly, there is a discussion and conclusion in which we present a comprehensive discussion that evaluates the most important criteria and puts forward strategies to guide policymakers.

## Literature Review

The vast amount of studies in the literature were reviewed in this study. In addition, we distinguished the causes and effects of selection factors from the studies. When identifying these factors, we built on the work of Paulino and Castano (2019), who identified seven main factors. In addition to these factors, we have included recent studies in the literature to classify international students' choice factors. According to the classification in question, there are environmental, economic, personal, cultural, social, legal, and political factors related to the higher education system.

Environmental factors include host countries' climate, environment quality, and the perception pattern of societal marketing and social responsibility

situations. These create the urban atmosphere preferred by international students (Zhai et al., 2019; Li, 2020). In general, environmental conditions and quality can be important motivation tools (Cao et al., 2016; Howes, 2021). Additionally, social and corporate marketing (Shah et al., 2020; Vrontis et al., 2007) and social responsibility (Vrontis et al., 2007) are other environmental factors.

Economic factors involve the direct and indirect program cost of the country and city. In addition, economic factors are perceived to include the financial situation of the country, economic development or growth of the country, differences between international students' entering and going out of countries, program cost or tuition fee, cost of living, cost of mobility (e.g., visa procedures), financial support or non-refundable scholarships, expected cost increase in the future, country size, location of institutions or institutions' distance from home, country's population, trade, and the existence of bilateral or economic relations. Thus, the geographical location of the country is crucial for international students (Garcia-Rodriguez & Mendoza Jimenez, 2015;Liu et al. 2018). Moreover, a country having reasonable living conditions and program costs for international students also affects the preferences (Ahmad & Buchanan, 2016; Maringe & Carter, 2007; Liu et al., 2018 Zhang & Zhou 2018). Another economic issue for international students is amount of scholarships and non-refundable financial support, because they make critical contributions to the cost of students' travel and education expenditures (Özoğlu et al., 2015; Cao et al., 2016; Kingeski & Nadal, 2020; Zhang & Zhu, 2020).

In addition, international students take the economic growth of the country where they will go into account (Ahmad & Shah, 2018; Wen & Hu, 2019). They aim to overcome career barriers like lack of opportunity in the country that they came from. In this context, they will be able to adapt to flexible labor markets in the globalized labor market, and they will get training during their education abroad. With the awareness of career and expected employment opportunities that can come about due to this educational experience, their possible future income growth can become a priority (Chien, 2015; Zhai et al., 2019). In a macro sense, population, climate, and bilateral commercial relations are also other aspects of economic factors (Wei, 2013; Cao et al., 2016).

Personal factors are inner interest in research and education, enthusiasm for learning, self-actualization/self-fulfilment, personal development/self-improvement, prestige, personal success, earning a degree, reasons related to

career (vocational development, employment/career opportunity, academic career, and career change), access to domestic education opportunities, international exploration, personal experiences, desire to experience another country's culture, desire to experience student life in another country, personal freedom, previous work/study or travel experiences, learning high-quality research, and students' desire to develop personally and professionally. In this respect, inner interest in research, education, and learning (Zhou, 2015) and academic requirements for international students to improve themselves are among the preference factors (Eder et al., 2010; Zhai et al., 2019; Li, 2020). Also, professional intellectual gains, employment opportunities (Pawar et al., 2020), and prestige expectations of international students in terms of personal development are among the personal factors. (Kingeski & Nadal, 2020).

Moreover, the desire to experience another country's culture, develop personally, and improve education are other personal factors (Mahmoud et al., 2020; Sarkodie et al., 2020; Zhang & Zhu, 2020). Additionally, employment opportunities in terms of career have a major role in decision-making processes (Eder et al., 2010; Cao et al., 2016; Jafar & Legusov, 2020). Further, personal freedom (Vrontis et al., 2007) and personal and professional development desire (Eder et al., 2010) are among the personal factors.

Cultural factors include cultural compatibility, adaptation to the cultural environment of the host country, acculturation, the pleasure of living in a place that has a global culture, the attraction of intercultural education, and the desire to experience another culture. There are many studies in the literature that show these factors. These situations, which are part of international students' decision-making factors, can occur in different geographies. In this framework, cultural compatibility (Ahmad & Buchanan, 2016), which is defined as the similarity between the host country and the culture of origin, can be distinctive (Ward & Kennedy, 1999; Kondakçı, 2011; Özoğlu et al., 2015; Kingeski & Olivella, 2018). Moreover, the experience of another country's culture and the attractiveness of international education are other cultural factors (Pawar et al., 2020; Cao et al., 2016).

Social factors are defined as suggestions from families, advice from friends, sense of belonging, consultant support, social networks, relationships arising from colonial connections, impact of service providers, and adaptation to a new environment. In addition, the sense of belonging to the place that

international students choose (Curtin et al., 2013) and particularly, suggestions from families and advice from friends, have a powerful effect on students' choice (Alfattal, 2017; Trung, 2020; Jafar & Legusov, 2020; Koenings et al., 2020). Social networks (Beech, 2018) and consultant support (Curtin et al., 2013) are among other direct and indirect factors. Service providers' student-oriented policies are another factor. (Padlee et al., 2010; Bhati & Anderson, 2012). Also, international students' skill in adapting to a new environment is a social factor (Khalid et al., 2020). Moreover, the framework of a country's colonial connections can guide the choices of international students (Perkins & Neumayer, 2014).

Legal and political factors include type of government, government policies, host country visa procedures and requirements, other legal requirements, safety, and security issues. In this context, policies that are open to international students are of vital importance. Other significant factors include the transfer of state and government funds through legal regulations, and having the identity of the host country preferred by skilled immigrants so that it can attract and retain more international students (Rioano et al., 2018; Paltridge et al., 2014). However, dual wage regimes sometimes exist for people from different countries and regions (Sá et al. 2018). Restrictive political attitudes create mobility and career barriers and make the status transition difficult (Mosneaga, 2015), and restricted international student enrolment at schools in a region (Tamtik & O'Brien-Klewchuk, 2018) is undesirable to international students within the framework of government policy. Furthermore, streamlined requirements for visas and other legal procedures are important to the stress-free and easy admission processes of international students (Shih, 2016; Lee, 2017). Regarding these, the security concerns of international students in their country of origin and the perception of a safe host country are crucial (Zhang & Zhou, 2018; Trung, 2020; Khalid et al., 2020; Howes, 2021). Moreover, the type of government in the country visited becomes another legal and political factor (Pan, 2013; Ahmad & Buchnan, 2016).

Higher education system factors include the quality of education, the reputation of the university institution, familiarity of the institution, the image or prestige of the institution, programs offered, the popularity of the university, university properties and facilities, the importance of academic staff, university rankings, and accelerated courses. In this framework, the quality, reputation,

and variety of the services provided by universities to students are at the forefront (Tantivorakulchai, 2014; James-MacEachern & Yun, 2017; Wen & Hu, 2019). In addition to that, academic factors, the quality with universality of education, and corporateness are other factors (Woodhouse, 1999; Fang & Wang, 2014; Singh, 2016; Shah et al., 2020). In addition, universities' strategies in maintaning student satisfaction, whether universities have a healthy study environment, corporate image, and reputation, and university ranking on the global stage are other higher education system factors (Briggs, 2007; Eder et al., 2010; Williams & Mindano, 2015; Ahmad & Shah, 2018; Trung, 2020; Khalid et al., 2020; Zhang & Zhu, 2020). Also, the option of accelerated courses is a relevant factor (Bhati et al., 2013).

In the field of study, numerous outcomes have become feasible. Moreover, this topic highlights the significance of economic and social development for countries. The literature review reveals that many studies have been done on numerical data, such as economic growth. However, international students' choices have been affected by non-numerical factors and studies about non-numerical factors, such as law and politics, are limited. So new research analyzed by considering non-numerical variables is needed. Therefore, the importance of taking both numerical and non-numerical factors into account at the same time is obvious. For this purpose, we have carried out weighting with the spherical fuzzy DEMATEL approach. Using this method, we found the order of importance of the variables and provided the opportunity to examine the effect of the variables on each other. Further, the variable was comprehensively tackled with spherical fuzzy numbers. This study has novelty because it considers non-numerical data. Also, there is further novelty in this research paper in that we performed the spherical fuzzy DEMATEL method in this research field.

Many studies analyze DEMATEL without using fuzzy numbers. (Zhao et al., 2021; Altuntas et al., 2021). The most significant disadvantage of the models used in these studies is that they cannot effectively manage the uncertainty in the decision-making process. Because of this problem, used with fuzzy numbers in the literature on multi-criteria decision-making methods. In this circumstance, triangular and trapezoidal fuzzy numbers are preferred in many models. However, there are criticisms that these models cannot fully handle uncertainty (Khairuddin et al., 2021). In this study, a model was created with spherical

fuzzy numbers. Thus, the aim was to minimize the uncertainty in the decision-making process. Therefore, it will be possible to achieve more effective results.

In the literature on decision-making processes different methods are used. Many studies aim to reach results using AHP and ANP methods (Okfalisa et a., 2021; Kieu et al., 2021). The biggest criticism of these methods is that only the importance weights of the criteria can be determined. However, in these methods, the causal relationship between the criteria cannot be determined. Nevertheless, factors affecting the preferences of international students may have causal effects on each other. Therefore, in the study, the DEMATEL method was chosen, and superiority was achieved compared to many models in the literature.

## Methodology

### Spherical Fuzzy DEMATEL

The DEMATEL method is a frequently used analysis today because it examines the interaction between criteria for decision making in multi-criteria situations. Also, this method is employed in order to determine different criteria in multi-criteria decision-making problems. In the DEMATEL method, the matrices obtained by the pairwise comparison of the "n" quantity criteria of the experts with the expert opinion are taken into account and the importance levels of the criteria are determined. (Dinçer & Yüksel, 2018).

Classic DEMATEL has become an updated method with different, developing number systems. In addition, the fuzzy DEMATEL method with the fuzzy number system is the most popular variant of DEMATEL that interprets linguistic terms in experts' opinions. In the framework of the developments in fuzzy numbers, Triangular, Gaussian, and Trapezoidal number systems have been improved (Yang et. Al, 2021). With the contribution of hybrid and interval-valued fuzzy numbers, the method has continued to be developed. Therefore the spherical fuzzy DEMATEL method used in this study is one of the most recent versions (Gül, 2020). Moreover, the steps of this method were implemented. The linguistic terms and their equivalents used in the spherical fuzzy DEMATEL method are given in Table 1 (Gül, 2020). The spherical fuzzy DEMATEL numbers are ($\mu$; $\nu$; $\pi$). "$\mu$" refers to the degree of membership, "$\nu$" value refers to non- membership, and "$\pi$" refers to hesitancy.

Table 1
*Spherical Fuzzy DEMATEL Linguistic Terms and Their Equivalents*

| **Linguistic Terms** | **(μ; ν; π)** |
|---|---|
| Strong (S) | (0.85; 0.15; 0.43) |
| Moderate (M) | (0.6; 0.3; 0.35) |
| Weak (W) | (0.35; 0.25; 0.25) |
| No (N) | (0; 0.3; 0.15) |

### *Step 1: Collection of expert opinion*

As the first step in the spherical fuzzy DEMATEL method, expert opinions ($\tilde{A}$) are collected from the values in this table as represented in equation (1) (Gül, 2020).

$$\tilde{A}_m = \begin{bmatrix} 0 & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & 0 \end{bmatrix} \quad a_{ij} = \left(\mu_{ij};\ \nu_{ij};\ \pi_{ij}\right) \quad m = 1,2,\dots,k \quad i,j = 1,2,\dots,n \tag{1}$$

The arithmetic mean of the opinions obtained from each "k" expert is taken by equation (2) (Gündoğdu & Kahraman, 2019).

$$Z^{agg} = \left\{ \left[1 - \prod_{i=1}^{k}\left(1-\mu_{\tilde{A}_{mi}}^{2}\right)^{\frac{1}{k}}\right]^{\frac{1}{2}}, \prod_{i=1}^{k} v_{\tilde{A}_{mi}}^{\frac{1}{k}}, \left[\prod_{i=1}^{k}\left(1-\mu_{\tilde{A}_{mi}}^{2}\right)^{\frac{1}{k}} - \prod_{i=1}^{k}\left(1-\mu_{\tilde{A}_{mi}}^{2}-\pi_{\tilde{A}_{mi}}^{2}\right)^{\frac{1}{k}}\right]^{\frac{1}{2}} \right\} \tag{2}$$

### *Step 2: Creating the direct relationship matrix*

The direct relation matrix ($\tilde{Z}$) is formed by the mean of expert opinions with the help of the values obtained from equation (2). The direct relation matrix is given in equation (3) (Gündoğdu & Yörükoğlu, 2021; Gül, 2020).

$$\tilde{Z} = \begin{bmatrix} 0 & \langle {\mu_{12}}^{agg};\ {\nu_{12}}^{agg};\ {\pi_{12}}^{agg}\rangle & \cdots & \langle {\mu_{1n}}^{agg};\ {\nu_{1n}}^{agg};\ {\pi_{1n}}^{agg}\rangle \\ \langle {\mu_{21}}^{agg};\ {\nu_{21}}^{agg};\ {\pi_{21}}^{agg}\rangle & 0 & \cdots & \langle {\mu_{2n}}^{agg};\ {\nu_{2n}}^{agg};\ {\pi_{2n}}^{agg}\rangle \\ \vdots & \vdots & \ddots & \vdots \\ \langle {\mu_{n1}}^{agg};\ {\nu_{n1}}^{agg};\ {\pi_{n1}}^{agg}\rangle & \langle {\mu_{n2}}^{agg};\ {\nu_{n2}}^{agg};\ {\pi_{n2}}^{agg}\rangle & \cdots & 0 \end{bmatrix} \tag{3}$$

### *Step 3: Normalization of the direct relationship matrix*

The obtained Z matrix is divided into three sub-matrices because it consists of three components: membership, non-membership, and hesitancy. These three sub-matrices are normalized with the help of equation (4) (Gül, 2020).

$$X = sZ \tag{4}$$

$$s = min\left[\frac{1}{\max_i \sum_{j=1}^{n}|z_{ij}|}, \frac{1}{\max_j \sum_{i=1}^{n}|z_{ij}|}\right] \quad (5)$$

The "s" in equation (4) is calculated with the help of equation (5). Here, it is normalized within itself for each of the three sub-matrices by calculating "s" value separately (Gül, 2020).

***Step 4: Creating a Total Influence matrix***

The matrices are normalized by multiplying with "s" value, by which the direct relation matrix is calculated. The normalized three sub-matrices are showed in equation (6) (Yuan et. al, 2021).

$$X^{\mu} = \begin{bmatrix} 0 & \cdots & \mu_{1n} \\ \vdots & \ddots & \vdots \\ \mu_{n1} & \cdots & 0 \end{bmatrix}; X^{v} = \begin{bmatrix} 0 & \cdots & v_{1n} \\ \vdots & \ddots & \vdots \\ v_{n1} & \cdots & 0 \end{bmatrix}; X^{\pi} = \begin{bmatrix} 0 & \cdots & \pi_{1n} \\ \vdots & \ddots & \vdots \\ \pi_{n1} & \cdots & 0 \end{bmatrix} \quad (6)$$

The obtained normalized matrices comprise the basis of the total influence matrix (T). Equation (7) is used in order to build T matrix. I matrix is an identity matrix here (Gül, 2020).

$$T = X + X' = X(I - X)^{-1} \quad (7)$$

X matrices are brought to the form of fuzzy numbers by performing Euclid normalization; because of the obtained sub-matrices from this equation, the nature of fuzzy numbers could be lost. The final T matrix is given in the equation (8) (Gül, 2020).

$$T = \begin{bmatrix} \langle \mu_{11}{}^{T};\ \nu_{11}{}^{T};\ \pi_{11}{}^{T} \rangle & \langle \mu_{12}{}^{T};\ \nu_{12}{}^{T};\ \pi_{12}{}^{T} \rangle & \cdots & \langle \mu_{1n}{}^{T};\ \nu_{1n}{}^{T};\ \pi_{1n}{}^{T} \rangle \\ \langle \mu_{21}{}^{T};\ \nu_{21}{}^{T};\ \pi_{21}{}^{T} \rangle & \langle \mu_{22}{}^{T};\ \nu_{22}{}^{T};\ \pi_{22}{}^{T} \rangle & \cdots & \langle \mu_{2n}{}^{T};\ \nu_{2n}{}^{T};\ \pi_{2n}{}^{T} \rangle \\ \vdots & \vdots & \ddots & \vdots \\ \langle \mu_{n1}{}^{T};\ \nu_{n1}{}^{T};\ \pi_{n1}{}^{T} \rangle & \langle \mu_{n2}{}^{T};\ \nu_{n2}{}^{T};\ \pi_{n2}{}^{T} \rangle & \cdots & \langle \mu_{nn}{}^{T};\ \nu_{nn}{}^{T};\ \pi_{nn}{}^{T} \rangle \end{bmatrix} \quad (8)$$

***Step 5: Calculation of row and column totals***

The rows and columns of the total influence matrix are added. The sum of the row is represented by matrix R and the sum of the column is represented by matrix C. The sum of the two spherical fuzzy numbers is added with equation (9) (Kahraman & Gündoğdu, 2020). R and C matrices are given with equations (10) and (11) (Gül, 2020).

$$\langle \mu_1, v_1, \pi_1 \rangle + \langle \mu_2, v_2, \pi_2 \rangle = \langle (\mu_1^2 + \mu_2^2 - \mu_1^2\mu_1^2)^{\frac{1}{2}}, v_1^2 v_2^2, \left((1-\mu_1^2)\pi_2^2 + (1-\mu_2^2)\pi_2^2 - \pi_1^2\pi_2^2\right)^{\frac{1}{2}} \rangle \quad (9)$$

$$r_i = \sum_{i=1}^{n} \langle {\mu_{ij}}^T;\ {\nu_{ij}}^T;\ {\pi_{ij}}^T \rangle \tag{10}$$

$$c_j = \sum_{j=1}^{n} \langle {\mu_{ij}}^T;\ {\nu_{ij}}^T;\ {\pi_{ij}}^T \rangle \tag{11}$$

Because they are fuzzy numbers, the sums that were obtained from the row and column equations convert to real numbers with equations (12) (Gül, 2020; Chang et. al., 2011).

$$score = (2\mu - \pi)^2 - (\nu - \pi)^2 \tag{12}$$

***Step 6: Calculation of criterion weights***

The R+C matrix is created by adding R and C matrices, whose score is calculated with the help of equation (12). The criteria weights (W) are calculated using the values of the obtained R+C matrix in equation (13) (Gül, 2020).

$$W_i = \frac{(R + C)_i}{\sum_{i=1}^{n} (R + C)_i} \tag{13}$$

## Results

In this part, the definitions of the criteria to be used in the analysis will be given first. Then, the criteria will be weighted with the SF-DEMATEL method. Finally, the effect of the criteria on each other in the NRM graphic will be examined.

***Defining the criteria***

The aim of this study is to determine the most important factors for international students in choosing a country for study abroad. For this purpose, seven factors were determined from the literature. These factors are detailed in Table 2.

Table 2
*Identification of Criteria*

| **Variables** | **References** |
|---|---|
| Environmental Factors (A1)<br>This criterion represents the climate and environmental quality of the host country. | Li, 2020; Howes, 2021 |

| | |
|---|---|
| Economic Factors (A2)<br>This criterion represents the economic development of the country and city and program cost. | Liu et al. 2018; Zhang & Zhou, 2020 |
| Personal Factors (A3)<br>This criterion represents self-improvement, career opportunity, and prestige. | Eder et al., 2010; Zhai et al., 2019 |
| Cultural Factors (A4)<br>This criterion represents the cultural compatibility, acculturation, and desire to experience another culture. | Özoğlu et al., 2015; Pawar et al., 2020 |
| Social Factors (A5)<br>This criterion represents family suggestions, friends' advice, and adaptation to new surroundings. | Khalid et al., 2020; Perkins & Neumayer, 2014 |
| Legal and Politic Factors (A6)<br>This criterion represents the type of government, government policies, visa procedures and other legal requirements of the host country, and security. | Le, 2017; Trung, 2020 |
| Higher Education System (A7)<br>This criterion represents the quality of education, university reputation, and academic staff. | Shah et al., 2020; Wen & Hu, 2018 |

These factors were sequentially determined: Environmental Factors, Economic Factors, Individual Factors, Cultural Factors, Social Factors, Legal and Political Factors, and Factors related to the Higher Education System. These seven criteria were evaluated by three experts who have at least 10 years of experience in this field. One of them is an academician in the field of international students, and the other two experts are mid-level managers working in international student institutions. The obtained evaluation table is given in Table 2.

Environmental Factors (A1) given in Table 2 include the climate and environmental quality of the host country. Economic Factors (A2) represent the country's economic development, and city and program costs. The third factor, which is Individual Factors (A3), represents personal development, career opportunity, and prestige. Cultural Factors (A4) includes cultural compatibility, acculturation, and the desire to experience another culture. Another factor is Social Factors (A5), which includes family suggestions, friends' recommendations. and adaptation to new surroundings. Legal and Political Factors (A6) include the type of government, government policies, host country visa and other legal requirements, and security. The last criterion included in the analysis is Higher Education System (A7), which includes the quality of education, university reputation, and academic staff.

## *The Weighting of The Criteria*

Table 3
*Expert opinions*

| | **A1** | **A2** | **A3** | **A4** | **A5** | **A6** | **A7** |
|---|---|---|---|---|---|---|---|
| A1 | 0 | N, W, S | W, W, S | W, S, S | M, S, S | N, M, S | W, W, S |
| A2 | N, S, M | 0 | S, M, S | M, M, M | M, S, M | W, M, M | M, W, S |
| A3 | W, M, W | S, S, S | 0 | M, M, S | M, S, M | W, M, M | M, M, M |
| A4 | W, W, M | M, W, M | S, S, S | 0 | W, S, S | W, W, M | W, W, M |
| A5 | W, M, M | M, S, M | M, S, S | M, S, M | 0 | W, M, M | W, W, S |
| A6 | W, S, M | W, S, M | M, M, S | M, W, M | M, M, S | 0 | M, S, M |
| A7 | W, W, M | S, S, M | S, S, S | M, M, M | M, M, W | W, S, M | 0 |

The linguistic expressions obtained from expert opinions were analyzed on the spherical fuzzy number equivalents shown in Table 3. The direct relation matrix (Z), which was acquired with the help of equation (2), is shown in Table (4).

The normalized matrix was achieved using equations (4)-(6) with help from the direct relation matrix, and the normalize matrix table is shown in Table 5.

The total influence matrix was calculated from the obtained normalize matrix with the help of equations (7) and (8). Three sub-matrices were obtained here and Euclid normalization was employed in order to protect the three sub-matrices' conformity to the spherical fuzzy numbers. The produced T matrix at the end of these calculations is shown in Table 6.

The sum of the rows and columns was made with the help of equations (10)-(11). C and R score values were calculated with equation (12) and this equation was the sum of the spherical fuzzy row and column number matrices. C+R scores were measured by taking the sum of these two scores. Further, the factors' weights were calculated from this sum with the help of equation (13). The calculated values are shown in Table 7.

In multi-criteria decision-making methods, the sum of the weights of all criteria is always set to 1. Therefore, if the number of criteria of interest increases, the values get closer to each other. However, the small difference between them does not mean that they are of similar importance. The differences appear small because the sum is 1. Looking at the multi-criteria decision-making techniques in the literature, it is possible to see studies with close weights (Leblebicioğlu and Keskin, 2021; Candan and Cengiz,

Table 4
*Direct relation matrix*

| | A1 | | | A2 | | | A3 | | | A4 | | | A5 | | | A6 | | | A7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A1** | 0,339 | 0,227 | 0,377 | 0,392 | 0,443 | 0,432 | 0,390 | 0,451 | 0,429 | 0,408 | 0,399 | 0,436 | 0,406 | 0,397 | 0,431 | 0,408 | 0,408 | 0,441 | 0,400 | 0,431 | 0,433 |
| **A2** | 0,403 | 0,402 | 0,406 | 0,331 | 0,221 | 0,341 | 0,393 | 0,401 | 0,393 | 0,387 | 0,415 | 0,385 | 0,392 | 0,409 | 0,393 | 0,389 | 0,411 | 0,388 | 0,397 | 0,425 | 0,397 |
| **A3** | 0,375 | 0,402 | 0,357 | 0,394 | 0,355 | 0,365 | 0,323 | 0,204 | 0,313 | 0,387 | 0,380 | 0,370 | 0,383 | 0,389 | 0,367 | 0,380 | 0,393 | 0,359 | 0,381 | 0,358 | 0,356 |
| **A4** | 0,348 | 0,402 | 0,336 | 0,345 | 0,417 | 0,332 | 0,362 | 0,370 | 0,342 | 0,296 | 0,205 | 0,292 | 0,362 | 0,385 | 0,349 | 0,346 | 0,407 | 0,334 | 0,342 | 0,338 | 0,329 |
| **A5** | 0,386 | 0,407 | 0,382 | 0,388 | 0,401 | 0,387 | 0,389 | 0,401 | 0,386 | 0,391 | 0,398 | 0,391 | 0,326 | 0,226 | 0,334 | 0,384 | 0,410 | 0,381 | 0,388 | 0,428 | 0,391 |
| **A6** | 0,410 | 0,390 | 0,419 | 0,395 | 0,413 | 0,407 | 0,392 | 0,416 | 0,403 | 0,386 | 0,427 | 0,395 | 0,397 | 0,407 | 0,405 | 0,336 | 0,220 | 0,353 | 0,405 | 0,418 | 0,408 |
| **A7** | 0,379 | 0,381 | 0,363 | 0,394 | 0,351 | 0,372 | 0,392 | 0,350 | 0,367 | 0,380 | 0,376 | 0,361 | 0,373 | 0,399 | 0,357 | 0,397 | 0,358 | 0,381 | 0,326 | 0,183 | 0,317 |

Table 5
*Normalize matrix table*

| $X^{ik}$ | A1 | A2 | A3 | A4 | A5 | A6 | A7 | | $X^{ij}$ | A1 | A2 | A3 | A4 | A5 | A6 | A7 | | $X^{ij}$ | A1 | A2 | A3 | A4 | A5 | A6 | A7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0 | .61 | .63 | .77 | .8 | .66 | .63 | | A1 | 0 | .22 | .21 | .18 | .17 | .21 | .48 | | A1 | 0 | .48 | .48 | .49 | .47 | .48 | .48 |
| A2 | .66 | 0 | .8 | .6 | .72 | .54 | .68 | | A2 | .21 | 0 | .17 | .2 | .18 | .22 | .47 | | A2 | .48 | 0 | .47 | .35 | .46 | .33 | .47 |
| A3 | .46 | .85 | 0 | .72 | .72 | .54 | .6 | | A3 | .23 | .15 | 0 | .18 | .18 | .22 | .35 | | A3 | .3 | .45 | 0 | .46 | .46 | .33 | .35 |
| A4 | .46 | .54 | .85 | 0 | .77 | .46 | .46 | | A4 | .23 | .22 | .15 | 0 | .18 | .23 | .3 | | A4 | .3 | .33 | .45 | 0 | .49 | .3 | .3 |
| A5 | .54 | .72 | .8 | .72 | 0 | .54 | .63 | | A5 | .22 | .18 | .17 | .18 | 0 | .22 | .48 | | A5 | .33 | .46 | .47 | .46 | 0 | .33 | .48 |
| A6 | .68 | .68 | .72 | .54 | .72 | 0 | .72 | | A6 | .2 | .2 | .18 | .22 | .18 | 0 | .46 | | A6 | .47 | .47 | .46 | .33 | .46 | 0 | .46 |
| A7 | .46 | .8 | .85 | .6 | .54 | .68 | 0 | | A7 | .23 | .17 | .15 | .2 | .22 | .2 | 0 | | A7 | .3 | .47 | .45 | .35 | .33 | .47 | 0 |

Table 6
*T matrix*

| **T** | **A1** | | | **A2** | | | **A3** | | | **A4** | | | **A5** | | | **A6** | | | **A7** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | .34 | .23 | .38 | .39 | .44 | .43 | .39 | .45 | .43 | .41 | .4 | .44 | .41 | .4 | .43 | .41 | .41 | .44 | .4 | .43 | .43 |
| A2 | .4 | .4 | .41 | .33 | .22 | .34 | .39 | .4 | .39 | .39 | .42 | .39 | .39 | .41 | .39 | .39 | .41 | .39 | .4 | .42 | .4 |
| A3 | .37 | .4 | .36 | .39 | .36 | .37 | .32 | .2 | .31 | .39 | .38 | .37 | .38 | .39 | .37 | .38 | .39 | .36 | .38 | .36 | .36 |
| A4 | .35 | .4 | .34 | .34 | .42 | .33 | .36 | .37 | .34 | .3 | .21 | .29 | .36 | .39 | .35 | .35 | .41 | .33 | .34 | .34 | .33 |
| A5 | .39 | .41 | .38 | .39 | .4 | .39 | .39 | .4 | .39 | .39 | .4 | .39 | .33 | .23 | .33 | .38 | .41 | .38 | .39 | .43 | .39 |
| A6 | .41 | .39 | .42 | .4 | .41 | .41 | .39 | .42 | .4 | .39 | .43 | .39 | .4 | .41 | .41 | .34 | .22 | .35 | .41 | .42 | .41 |
| A7 | .38 | .38 | .36 | .39 | .35 | .37 | .39 | .35 | .37 | .38 | .38 | .36 | .37 | .4 | .36 | .4 | .36 | .38 | .33 | .18 | .32 |

2022; Kutlu Gündoğdu and Kahraman; 2020). Legal and Political Factors become the factor which has the biggest weight value, with 0.148 weight when the table was examined. Further, the second biggest factor after Legal and Political factors was determined to be Environmental Factors. After these two factors, Economic Factors have the third highest weight value, which is 0.146. Personal and Social Factors, and Factors related to the Higher Education System, are sequentially the fourth, fifth, and sixth factors. Lastly, Cultural Factors have the lowest weight. In the other word, they are determined to be the leasts important factor.

### *Drawing network relationship map (NRM)*

Finally, a network relationship map (NRM) graphic was drawn in order to show the effects among the factors. In order to create the graphic, the defuzzification total effect matrix (T) with the help of equation (12) was used (Gül, 2020). 0.14 value was taken as the mean value of this matrix, which was obtained as the threshold value. The influenced and influencing factors were determined by the matrix value above this value. The drawn graphic is given in Figure 1.

It was stated that factor A1 influenced factor A4 and A5 when the figure was investigated. Also, it is denoted that factor A4 affected factor A3. As a result, the factors other than A1 and A4 had an impact on the other factors apart from themselves.

Table 7
*C score, R score, C+R and factor weights*

| Factors | Comscore | R score | C+R | Weights |
|---|---|---|---|---|
| Environmental Factors | 1.09 | 1.03 | 2.13 | .147 |
| Economic Factors | 1.09 | 1.03 | 2.12 | .146 |
| Personal Factors | 1.06 | 1.03 | 2.09 | .144 |
| Cultural Factors | .81 | 1.03 | 1.84 | .127 |
| Social Factors | 1.05 | 1.03 | 2.08 | .143 |
| Legal and Political Factors | 1.11 | 1.03 | 2.14 | .148 |
| Factors related to the Higher Education System | 1.07 | 1.03 | 2.11 | .145 |

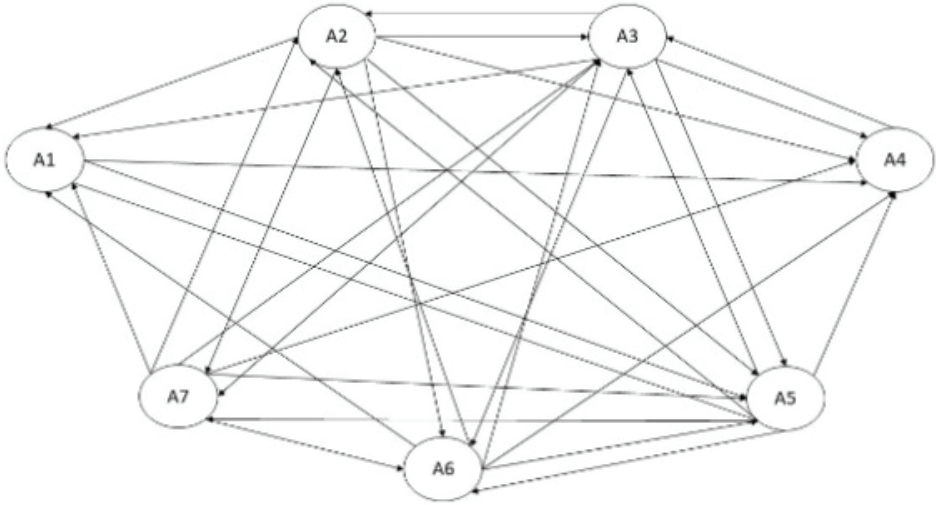



***Figure 1.*** Network Relationship Map (NRM).

## Conclusion and Discussions

In this study, we aimed to determine which factor or factors international students take most into consideration when choosing a country for study abroad. In this study, we determined seven criteria based on the literature and used spherical fuzzy DEMATEL as a method. According to the findings of the study, the most significant criterion was a legal and political element, and the second most significant criterion was economic factors. Also, it was found that cultural influences are the least relevant component.

Considering the results obtained from this study, with the highest criterion

weight, although the consequences are close, it is seen that legal and political factors are much more effective in attracting international students to the country compared to the other factors. In this event, it is clear that government policies that facilitate international students' visa procedures and admission processes and implement legal regulations for the potential future workforce make a significant difference in choice factors. Therefore, comprehensive regulations that represent both the potential workforce and institutionalism become important when considered in the context of social policy. The inclusive social policy perspective is a distinguishing factor, considering that international students primarily study independently. In a way, social policy arrangements for the employment of international students during the education process or after graduation may positively affect the selection factors.

Moreover, it is understood that the governance style practiced by the governments is effective in the country selection for international students. In other words, it is seen that international students will take into account a democratic governance style in the foreign country that they choose for education. In addition to these issues, it is understood that the safety factor is crucial for international students. In other words, international students want to feel safe in the country where they will study in order to have a more peaceful education. When this information is considered, it can be helpful for countries to regulate their policies, such as being open to international students in terms of financial conditions, admission processes, residency, and quotas to attract international students. Also, it is important that countries make their legal systems more democratic.

Concerning these, removing some legal barriers also helps international students come to a country in greater numbers. For example, it is indispensable in visa procedures to facilitate the process for international students who are successful and promise success. Furthermore, taking the necessary security precautions regarding where international students live and their routes to school makes these students more likely to choose the country.

On the other hand, establishing a functional online system for international students' admission process will contribute to reducing barriers in this process. Hence, it will be possible for countries to attract more international students when it is considered. This way, the opportunity to work with students from different countries who promise success will be obtained. Moreover, this

situation will significantly benefit the social development of the countries. In addition, having an excess of these students also contributes to the country's sustainable economic growth. For instance, as these students have met the costs such as accommodation, expenditures, and tuition fees, the foreign currency exchange from the country will access the host country. Therefore, this situation will reduce the economic breakdowns of the countries, and the countries will have a more robust economy.

On the other hand, it will be possible to establish better political relations between the host country, which accepts students, and the students' countries thanks to these suggestions. Moreover, after their education, international students tend to establish commercial relations with the host country because of their excellent experiences. As can be seen, the results obtained in this study provide contributions to attracting more international students and both social and economic development.

The results of this study are parallel to many studies in the literature. Concerning the legal and political factors are the most important factor in our study, Gribble (2008) noted that the number of international students had increased significantly after the regulation preventing the permanent residence of international students was removed. Similarly, Sin et al. (2019) emphasized that there is an important criterion in policies to make higher education attractive when the admission process and residence transactions are policed proactively with the consulate and local authorities. On the other hand, Liu & Zhu (2019) found that increasing the high quality of education and competitive power is due to political factors. Similarly, Mok et al. (2020) researched the type of government related to the political structure evaluated within the legal and political factors. It is denoted that the hierarchical and central political system maintains its power at the point of autonomy of the higher education institution.

The political structure has direct and indirect effects on the quality of education and the preferences of international students who come from abroad. In addition, Yankun and Xinrong (2020) mentioned the aspects of political stability that influence choices. For this reason, this factor is critical as a reflection of the political regime.

The scope of this study is limited. For example, the ranking of the countries was not done, but only the criteria were implemented. Another constraint is

that there needs to be a case study applied to international students. Therefore, this sudy is only at the suggestion level. In further studies, a comparative analysis can be done by using a different method from that used in this study, which we have performed using the DEMATEL method. For example, AHP and Entropy methods can be used. Furthermore, analysis with spherical fuzzy sets can be performed with Pythagorean sets. According to the obtained analysis results, the performance of different countries can be listed with TOPSIS and VICOR methods.

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