Management Science Letters 10 (2020) 3063–3070

Contents lists available at GrowingScience

Management Science Letters

homepage: www.GrowingScience.com/msl

Applying the FDEMATEL technique in developing and prioritizing strategies of economic participation development in urban management of Ahvaz Metropolis

Majid Goodarzi[a*] and Zahra Soltani[b]

[a]*Assistant Professor of Geography and Urban Planning, Shahid Chamran University of Ahvaz, Ahvaz, Iran*
[b]*Assistant Professor of Geography and Rural Planning, Shahid Chamran University of Ahvaz, Ahvaz, Iran*

C H R O N I C L E

Article history:
Received: April 8, 2020
Received in revised format: April 25 2020
Accepted: May 14, 2020
Available online: May 14, 2020

Keywords:
Economic participation
Urban management
FDEMATEL
Ahvaz Metropolis

A B S T R A C T

Generally speaking, the severe financial constraints of the municipalities on the one hand, and the inefficiency of state investment companies on the other hand, affirm the necessity of private sector participation in the efficiency of providing services to cities. The performance of the private sector in comparison with the public sector has its own properties and characteristics, the most important of which are high performance and access to diverse resources. Valuable international experience in the field of municipalities' utilization of private sector capacities to implement urban services projects confirms this issue. The present study was conducted aiming to apply fuzzy multi-criteria decision-making technique (FMCDM) in formulating and prioritizing strategies for developing economic participation in urban management of Ahvaz Metropolis. The main research approach was developmental-applied, descriptive, analytical, and survey research. Based on the SWOT analysis, identifying and evaluating the current situation were done and then, according to the identified criteria, four strategies were developed. Finally, using FDEMATEL technique, strategies were prioritized. The research results show that the strategies such as doing pathological study in Ahvaz municipality investment; designing and providing investment packages; increasing the positive interaction with the executive and necessary devices with the participation of other interested organizations for the promotion of services and performing tasks based on laws, regulations and guidelines delegated to the municipality; forecasting the incentive system to reduce the risk of projects; providing Cadastre and GIS; designing a database of investors and urban projects; setting up an investment facilitation team with the participation of departments related to the municipality; and identifying regular investment capacities related to inherent duties of the municipality are among the most important strategies in developing economic participation in Ahwaz Metropolis.

1. Introduction

Many definitions and interpretations of the concept "partnership" have been presented so far. The breadth of this concept and its various interpretations are its special characteristics. The term is as old as the human social life (Blacher, 2005: 153). Serjel (1970) points up that "partnership is a pleasant concept in many countries, but almost everyone who uses the term thinks differently about it" (Lane, 2005: 294-295). According to Hall, the conflict between pragmatic views and mainly philosophical views of partnership has led to a multifaceted concept and appearing with different meanings over time (Azkia & Ghaffari, 2001: 12). Studying the evolutionary course of human societies shows that sustainable development is possible when human beings have cooperated with each other during their lives (Haddad Tehrani & Moharramnejad, 2002). Partnership has a fundamental effect on the process of sustainable urban planning and development in two ways: first, partnership is a necessary instrument for achieving proper knowledge and decision-making; and second, it is the only way to take advantage of a city's natural and human resources and its citizens for realization of sustainable urban development plans (Matuf, 1999).

* Corresponding author.
E-mail address: m.goodarzi@scu.ac.ir (M. Goodarzi)

doi: 10.5267/j.msl.2020.5.017

Nowadays more than half of the world's population lives in cities (Varol et al., 2010: 1). Urbanization is an unstoppable force because we are moving towards a position where the urban areas cover more than 3% of the planet's surface (Angel et al., 2012). Urbanization is expanding rapidly in all indicators. Given the expansion of urbanization and the need for safe, green, and clean cities, urban managers make attempts to meet the expectations of citizens and organizations from cities and urban management and plan to do measures for managing their cities in today's evolving space. The capacity of urban services and urban development management depends on economy, planning, and financial management (Arns, 2012).

Among the various sections of urban management, the provision of financial resources and revenues for municipalities is of particular significance because, on the one hand, municipal revenues have a major effect on providing services to citizens, and on the other hand, income insufficiency neither provides the necessary services in cities, nor makes it difficult to implement all urban plans and programs (Jamshidzadeh, 2003: 29). Moreover, the lack of continuous and sustainable sources of income may disrupt the financial and budgetary planning of municipalities so that the growing costs of municipalities in the coming years may increase (Qaderi, 2006: 23). Peter Martin believe, the most important challenge of urban management in the third millennium will be to focus on costs. So, earnings education will be the focus of policy making at the local management level (Martin, 1997: 103). The significance of the issue becomes clear when we know that more than 95% of the financial resources of municipalities are provided from local revenues within cities, i.e. dependence on government grants is less than 5% (Ziari et al., 2012: 108). Nowadays one of the principles of sustainable urban development is the physical growth and expansion of cities with basic and logical criteria. Sustainable urban development is the development based on real needs and rational decisions, taking into account various economic, social, and environmental considerations. Among the factors affecting the physical development of a city are stable incomes, in which the level of productivity and access to sustainable incomes will determine the type and amount of urban development with the program (Pejouyan et al., 2011). Providing financial resources is one of the most important tasks of public institutions such as municipalities. Although municipal financial resources can be obtained in different ways, not all of them have the feature of sustainable income. The sustainability of incomes requires that, firstly, they have a relative continuity and, secondly, they do not expose the quality of a city to threats and destruction (Sharze'i, 2008).

One of the ways to accelerate economic development is to develop and create jobs and attract investment in cities. In addition, attracting investment can lead to the reform of cities' management system, the exchange of economic experience, and the use of new technologies. In the face of the problems such as population explosions; the poor conditions of vehicles on the streets and roads; pollution and the environment; floods of rural migrants; the growing wave of marginalization, and hundreds of other specialty management issues, participatory programs and private investment have a special place among urban managers since municipalities face budget constraints in the implementation of urban projects. The present study aims at formulating and prioritizing the strategies for developing economic partnership in the urban management of Ahvaz metropolis.

1.1. Review of literature

Researchers has performed significant investigations on this area, in addition to increasing their abilities and authorities on the research subject and present precise understanding of different indicators of that area. Willoughby (2013) examined the effect of private sector partnership on the economic growth of a Brazilian city, believing that these two variables have a two-way relationship. Accordingly, not only will the private sector partnership in the financing of the city lead to its economic growth, but also the economic growth in the next period will increase the public private partnership. Investigating the income structure of municipalities in developing countries, Nascio (2006) concluded that transparency in the mechanism of laws is an important factor in the development of private sector partnership and interaction with municipality in providing local finance. Albert (2010) surveyed the main obstacles for the successful implementation of public-private partnerships in Beijing and Hong Kong. As the research findings showed, there were three obstacles: delays in the negotiation process, insufficient experience and skills, and long delays due to political disputes as the main ones to the development of partnership in Beijing. The first and third obstacles were observed in Hong Kong. Morrissey and Udomkerdmongkol (2012) identified the factors affecting investment by examining the annual data of 45 developing countries. They concluded that investment is higher in countries with good governance indicators, and that corruption and political instability are the most important barriers to investment. In a large-scale study involving African continents titled "investing in poor countries: the private sector as a natural resource and inconsistency in Africa", Besada (2013) concluded that private equity investment is highly affected by the risk of expropriation, degree of freedom, and bureaucracy. Economic growth is also affected by expropriation and non-compliance to contracts in long run. He also pointed out that the risk of civil war, bureaucracy and on-compliance with the contracts by the government play key roles in investment performance and economic growth. Chan et al. (2015) did a study to explain the types of partnership contracts and their advantages and disadvantages using data from 1985 to 2008, relying on econometric discrete choice models, the Logit model, and Probit model. They concluded that large private-sector partnerships occur in independent operational projects; governments with high debt pressure are more willing to attract private investment; and high tax burden and government revenues reduce the attraction of private partnership through taxes. In a study titled Swapan (2016) proposed a model of partnership for developing countries. They did a case study in Dhaka, the capital of Bangladesh. Research findings showed that the political, social and institutional contexts of partnership in developing countries are different. Most development models have been designed for developed countries, while the realities of developing countries are very different. In these countries, there are parallel systems of management as well as a variety of formal and

informal partnerships. People find informal partnership practices more efficient than formal ones. In designing the model of citizen partnership in these countries, public opinion should be used and with institutional and organizational reforms in local administrations, citizen partnership should be included in the formal planning processes.

2. Methodology

The present applied-theoretical study employed a descriptive-analytical research method. The data was collected via library resources and documentary research, survey research, and interviewing techniques (interviews with citizens and urban planning experts). The research statistical population consisted of 30 experts and specialists in the field of investment and partnership, all of whom were selected as the sample due to the limited number. To analyze the data, FMEMATEL was integrated with SWOT. The study seeks to present the strategies for developing economic partnership in urban management in accordance with various indicators of features of economic partnership in Ahvaz metropolis via a SWOT analysis.

2.1. FDEMATEL

DEMATEL is an important technique for system analysis designed and developed by the Geneva Research Center. As a type of decision-making technique based on pairwise comparisons, DEMATEL utilizes the experts' opinions for extracting the factors of a system and systematizing them by applying the principles of graph theory. It provides a hierarchical structure of the factors in the system with interactions, so that it determines the effect size of these relationships as numeric scores (Taghvaei & Goodarzi, 2016: 9-8). DEMATEL is employed to identify and study the interrelationships between metrics and to map network relationships. Since directed graphs can better represent the relationships of components of a system, DEMATEL is based on graphs that can divide the involved factors into two cause and effect groups and make the relationship between them perceptible as a structural model (Jeng & Tzeng, 2012). The advantage of this method over the network analysis technique is its transparency in reflecting the interrelationships among a wide range of components. Thus, experts are able to express their opinions about the effects (direction and severity of effects) among the factors with more mastery (Fontela, 2000). In fact, the advantage of this method is the use of the feedback in relationships, so that each component can affect all components with the same, higher, and lower levels, and in return, be affected by each of them. The weights of factors are ultimately determined by all available factors, or in other words, the whole model. It should be noted that the matrix derived from the DEMATEL technique (internal communication matrix) actually forms part of the super matrices. In other words, DEMATEL does not operate independently, but as a subsystem of a larger system such as ANP. Structuring complex factors in the form of cause-effect groups is one of the most important functions and reasons for its widespread use in problem solving processes. By dividing a large set of complex factors in the form of cause-effect groups, it puts the decision maker in a more appropriate condition than understanding the relationships. This leads to a greater understanding of the position of factors and the role they play in interactive effectiveness (Zhou et al., 2011: 249). This method enjoys several advantages: it is an efficient process in identifying the hierarchy and relationships between system factors. As a type of decision-making technique based on pairwise comparisons, DEMATEL utilizes the experts' opinions for extracting the factors of a system and systematizing them by applying the principles of graph theory. It provides a hierarchical structure of the factors in the system with interactions and interactions, so that it determines the effect size of these relationships as numeric scores (Asgharpour, 2010).

These diagrams depict the relationship between the components of a system. The numbers on each diagram indicate the effect size of one component on another. Therefore, this method can turn the relationships between the components into a perceptual structural model of the system (Rabiee & Shahandeh, 2011). This approach was based on the idea that the proper use of scientific research methods could improve the complex structure of problems and contribute to the identification of practical solutions with hierarchical structure (Tzeng et al., 2010: 211). The fuzzy set theory can be challenged by the ambiguity of human thought and expression in decision making (Reyes et al., 2011: 779). Linguistic estimation can be effective on dealing with ambiguities involved in the decision-making process. A language variable is the one expressing values in the form of phrases and sentences in a natural language. Linguistic variables are used as variables whose values are not numbers but linguistic expressions can effectively describe quantitative expressions. The method of linguistic expression is a natural and effective way for decision makers to express themselves. In practice, linguistic values can be represented by fuzzy numbers (triangular fuzzy numbers are usually used). A phase set $\tilde{A}$ is a subset of the expression X, which is a set of ordered pairs and is represented by the membership function $\mu_{\tilde{A}}(x)$ denoting $\mu_{\tilde{A}}(x) : X \to [0,1]$. The value of the function $\mu_{\tilde{A}}(x)$ for the fuzzy set $\tilde{A}$ is called the value of the membership X in the fuzzy set $\widetilde{A}$, indicating the degree to which x is a component of the fuzzy set $\tilde{A}$. It is assumed that $\mu_{\tilde{A}}(x) : X \in [0,1]$, which $\mu_{\tilde{A}}(x) = 1$ represents that x belongs entirely to $\tilde{A}$, while $\mu_{\tilde{A}}(x) = 0$indicates that x does not belong to the fuzzy set $\widetilde{A}$.

$$\tilde{A} = \{x, \mu_{\tilde{A}}(x)\}, \qquad x \in X$$

where $\mu_{\tilde{A}}(x)$ is a function of the membership and X = {x} represents a set of components x.
A triangular fuzzy number $\widetilde{N}$ can be defined as a three-component (l, m, r) one, and the function of the membership $\mu_{\widetilde{N}}(x)$ is defined as:

$$\mu_{\tilde{N}}(x) = f(x) = \begin{cases} 0 & , \quad x < l \\ (x-l)/(m-l), & l \le x < m \\ (r-x)/(r-m), & m \le x < r \\ 0 & , \quad x \ge r \end{cases}$$

where *l, m* and *r* are real numbers and l <m <r.

Given the characteristics of triangular fuzzy numbers and expansion principle, the operating rules of two triangular fuzzy numbers, $\tilde{A} = (a_1, a_2, a_3)$ and $\tilde{B} = (b_1, b_2, b_3)$ are as follows:

The sum of two fuzzy numbers$\oplus$:

$$(a_1, a_2, a_3) \oplus (b_1, b_2, b_3) = (a_1 + b_1, a_2 + b_2, a_3 + b_3)$$

The subtraction of two fuzzy number$\ominus$:

$$(a_1, a_2, a_3) \ominus (b_1, b_2, b_3) = (a_1 - b_1, a_2 - b_2, a_3 - b_3)$$

The multiplication of two fuzzy numbers:

$$k \otimes (a_1, a_2, a_3) = (\mathrm{k}a_1, ka_2, ka_3)$$

The division of two fuzzy numbers:

$$\frac{(a_1, a_2, a_3)}{(b_1, b_2, b_3)} \cong (a_1/b_1, a_2/b_2, a_3/b_3)$$

An effective fuzzy aggregation method is needed to deal with group decision-making problems in a fuzzy environment. Human judgments with fuzzy language variables are fuzzy numbers, which is a non-fuzzy method for converting definite components to required scores. The converting fuzzy data into crisp scores (CFCS) defuzzication method is based on determining left and right scores by fuzzy minimum and maximum scores as well as the total score determined as a weighted mean based on membership functions. They now provide a more appropriate definite value when compared to other methods. To further develop the FDEMATEL method for group decision making in the fuzzy environment, the following steps are to be taken:

Step 1: Design a fuzzy linguistic scale: To deal with ambiguities in human evaluation, the linguistic variable "effect" is used with five linguistic terms such as {no, very low, low, high, very high} which are positive in triangular fuzzy numbers (lij‹mij‹rij) as shown in Table 1.

Table 1

Designing a fuzzy linguistic scale

Linguistic options	Definite numbers	triangular fuzzy numbers
Very high effect	4	(0.75, 1, 1)
High effect	3	(0.5, 0.75, 1)
Moderate effect	2	(0.25, 0.5, 0.75)
Low effect	1	(0.00, 0.25, 0.5)
No effect	0	(0.00, 0.00, 0.25)

Step 2: Fuzzy calculation of direct effects matrix: as the experts' opinions shows, via linguistic scales from natural language and the relationship between components, the fuzzy direct effect matrix $\widetilde{D}$ can be obtained by the following formula:

$$\widetilde{D} = \left[\tilde{d}_{ij}\right]_{n\times n}, \text{ي} \tilde{d}_{ij} = \left(d_{ij}^{l}, d_{ij}^{m}, d_{ij}^{r}\right)$$

As a result, matrix $\widetilde{D}$ is derived from direct relationship, which show a two-way comparison of a causal relation. Suppose n is a variable that is affected by this system; the matrix of the direct effects of $\widetilde{D}$ is shown below:

$$\begin{bmatrix} 0 & d_{12} & \cdots & d_{1n} \\ d_{21} & 0 & \cdots & d_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ d_{n1} & d_{n2} & \cdots & 0 \end{bmatrix}$$

Step 3: Normalize the direct fuzzy effect matrix: according to the fuzzy direct effect matrix $\widetilde{D}$, the normalized fuzzy direct effect matrix $\widetilde{N}$ can be obtained using the following formula.

$$\widetilde{N} = \widetilde{D}/_{u}$$

where,

$$u = \max_{i,j}\left\{\max_{i} \sum_{j=1}^{n} d_{ij}\,, \max_{j} \sum_{i=1}^{n} d_{ij}\right\} \quad , \; i,j \in \{1, 2, \ldots, n\}$$

$$\widetilde{N} = \left[\tilde{e}_{ij}\right]_{n\times n}, \tilde{e}_{ij} = \left(e_{ij}^{l}, e_{ij}^{m}, e_{ij}^{r}\right)$$

Step 4: Obtaining the fuzzy total effect matrix: When the matrix of the normal fuzzy direct effect is N ~ = (Nl, Nm, Nr), Nl = [elij] n * n and Nm = [emij] n * n and Nr = [erij] n * n, the fuzzy total effect matrix T ~ is obtained by the following equation where I is a single matrix:

$$\tilde{T} = \left[\tilde{t}_{ij}\right]_{n\times n}, \text{که } \tilde{t}_{ij} = \left(t_{ij}^{l}, t_{ij}^{m}, t_{ij}^{r}\right)$$

Step 5: defuzzification of definite values: Using the CFCS method shown in the equations, the fuzzy total effect matrix T ~ = [n * n] with definite values to the total effect matrix T = [n * n]

$$x = \left[\tilde{t}_{ij}\right]_{n\times n}, \text{که } \tilde{t}_{ij} = \left(t_{ij}^{l}, t_{ij}^{m}, t_{ij}^{r}\right)$$

Step 6: Determination of the threshold value: The threshold value is calculated by averaging the values of the defuzzified matrix (Yang et al., 2008).

$$x = \left[\tilde{t}_{ij}\right]_{n\times n}\alpha = \left(\sum_{I}^{N} = 1\sum_{\mathrm{J}}^{N} = 1[\mathrm{TIJ}]\right)/\mathrm{N}$$

Step 7: Analysis of results: In this step, the sum of rows (given effects) and the sum of columns (received effects) separately as the effective vector $d = (d_1, \dots, d_i, \dots, d_n)'$with factor j (j=1,2,…,n) and the effective vector $r = (r_1, \dots, r_i, \dots, r_n)'$ are expressed by the factor I (i=1,2,…,n) using the following equation. Then, jє{1,2,…,n}, i, and i = j of the horizontal axis vector (d + r) is formed by summing up the vector D with the vector R, showing the sum of the important values of each criterion. Similarly, a vertical axis vector (d-r) is formed by the detraction of the vector D from the vector R, which may separate the standard from an operating group and an affected group. In general, when the value $d_i - r_i$ is higher, the criterion belongs to the cause group. However, if the value $d_i - r_i$ is lower, the criterion belongs to the affected group. Therefore, the cause-effect diagram can be plotted by drawing the data set {i=1, 2,…,n} $(d_i - r_i)|\,(d_i + r_i)$ as follows:

$$T = \left[t_{ij}\right]_{n\times n}, \quad i,j \in \{1,2,\dots,n\} \qquad d = \left[\sum_{j=1}^{n} t_{ij}\right]_{n\times 1} = [t_i]_{n\times 1} = \left[d_j\right]_{n\times 1} \qquad r = \left[\sum_{i=1}^{n} t_{ij}\right]_{1\times n}' = \left[t_j\right]_{n\times 1} = \left[r_j\right]_{n\times 1}$$

where the vector $d = (d_1, \dots, d_i, \dots, d_n)'$ expresses the sum of the rows and the vector $d = (d_1, \dots, d_i, \dots, d_n)'$ shows the sum of the columns based on the of the total effect matrix= $\left[t_{ij}\right]_{n\times n}$, respectively.

3. Findings

3.1. Determining the internal and external factors affecting the development of economic partnerships (SWOT matrix)

After investigating the relevant data, the major internal and external factors affecting the development of economic partnerships in Ahvaz metropolis were identified and placed in the evaluation matrix. The number of internal factors was determined to be 17 factors, of which 3 factors were identified as strengths and 14 factors were identified as weaknesses of economic partnerships. The number of external factors was determined as 15 factors, of which 8 factors were identified as opportunities for economic partnerships and 7 factors as threats.

3.2. Determining the cause-effect relationships between SWOT indicators using FDEMATEL

Based on the explanations of FDEMATEL in the methodology section, in this section we find the cause-effect relationships between the four SWOT pillars:

Table 2
Significance and effectiveness of the criteria of internal environment indicators in the SWOT matrix

Type of relationship	Indicators	Definite numbers		Rank
		$(\tilde{D}_i + \tilde{R}_i)^{def}$	$(\tilde{D}_i - \tilde{R}_i)^{def}$	
Cause	S1: Existence of investment method and partnership in the Municipality of Ahvaz	4.461	0.644	2
Cause	S2: Existence of investment in the organizational structure of the Municipality of Ahvaz	4.565	0.653	1
Effect	S3: Experience in identifying investment risks in the Municipality of Ahvaz	4.339	-0.106	3
Cause	W1: Management instability	4.207	0.778	3
Cause	W2: Lack of appointment system	4.129	0.631	4
Cause	W3: Lack of suitable six-acre lands in municipal ownership (no exclusive land)	3.838	0.626	5
Cause	W4: no use of different methods in attracting investors	3.679	0.595	7
Effect	W5: Inefficiency of investment methods and economic partnerships	3.792	-0.112	11
Cause	W6: Unsuccessful experience of previous investors and their low confidence	4.491	0.855	1
Effect	W7: Lack of a comprehensive study of investment opportunities	3.992	-0.106	9
Cause	W8: fear of partnership in investment processes in the Municipality of Ahvaz	4.327	0.793	2
Effect	W9: Lack of proper database of investors in various fields	3.559	-0.126	12
Cause	W10: Failure of inter-departmental administrative relations processes in the Municipality of Ahvaz	3.834	0.607	6
Effect	W11: Insufficient information about the existence of the deputy (organizational structure) related to investment in the Municipality of Ahvaz	3.861	-0.107	10
Cause	W12: Failure of the current structure of the Deputy for Investment Development	3.562	0.500	8
Effect	W13: Lack of documentation of investment processes and instructions (working flow)	3.313	-0.152	13
Effect	W14: Lack of appropriate specialized training in attracting investors	3.178	-0.160	14

Table 3
Significance and effectiveness of criteria of external environment indicators in SWOT matrix

Type of relationship	Indicators	Definite numbers		Rank
		$(\tilde{D}_i + \tilde{R}_i)^{def}$	$(\tilde{D}_i - \tilde{R}_i)^{def}$	
Cause	O1: The existence of private sector investors in Ahvaz	4.033	0.451	4
Cause	O2: Using different methods in financing (partnership bonds, sukuk, securities, etc.)	4.270	0.568	2
Cause	O3: Ahvaz Industrial-Petroleum Brand, despite the headquarters of the oil-rich southern regions, refineries, steel industries, rolling and...	4.519	0.603	1
Effect	O4: Having a valuable historical heritage, attractions left over from the imposed war and suitable natural areas for the development of tourism in Khuzestan province	3.779	-0.240	6
Effect	O5: effective existence of Kārūn river on Ahvaz city	3.351	-.276	8
Effect	O6: Closeness to Arvand Free Zone and other ports	3.789	-.130	5
Effect	O7: Livability of Ahvaz metropolis at night	3.727	-0.255	7
Cause	O8: existence of rich landlords in Ahvaz metropolis	3.887	0.548	3
Cause	T1: Existence of oil wells and oil facilities and their supply in urban areas and	3.274	-0.151	7
Cause	T2: Lack of coordination of investment institutions in the province	3.533	0.4	2
Cause	T3: Lack of rules	3.336	0.213	4
Cause	T4: effectiveness of the pressures of political factions in the city and urban organizations	3.707	0.472	1
Cause	T5: Economic instability	3.418	0.386	3
Effect	T6: Air pollution (such as fine dust, etc.)	3.396	-0.106	5
Effect	T7: Existence of high groundwater levels	3.288	-0.108	6

The index in the final hierarchy is denoted by the columns $(\widetilde{\boldsymbol{D}}_{\boldsymbol{i}} - \widetilde{\boldsymbol{R}}_{\boldsymbol{i}})^{\boldsymbol{def}}$ and $(\widetilde{\boldsymbol{D}}_{\boldsymbol{i}} + \widetilde{\boldsymbol{R}}_{\boldsymbol{i}})^{\boldsymbol{def}}$, so that $(\widetilde{\boldsymbol{D}}_{\boldsymbol{i}} - \widetilde{\boldsymbol{R}}_{\boldsymbol{i}})^{\boldsymbol{def}}$ represents an index (along the ordinate (X) axis). This situation, if positive, is a cause, and if negative, is an effect. $(\widetilde{\boldsymbol{D}}_{\boldsymbol{i}} + \widetilde{\boldsymbol{R}}_{\boldsymbol{i}})^{\boldsymbol{def}}$ Indicates the total intensity of an index (along the abscissa (Y) axis) both in terms of cause (effectiveness) and (affectedness). Table 3 and Table 4 determine the position of the indicators based on the significance and relations. As seen in Table 3, in the analysis of the internal environment of the SWOT evaluation matrix, the S1 and S2 indicators are considered the causes due to their positive values; therefore, these indicators have high effects on the effectiveness of other indicators. In other words, the S3 indicator is *effect* due to its negative value and has a greater affectedness. As the table shows, the S2 indicator has a longer x-intercept than other indicators--that is, S2 is more significant than other indicators during their effectiveness and affectedness. Among weakness indicators of SWOT matrix, W1; W2; W3; W4; W6; W8; W10; W10; and W12 are considered as causes due to their positive values; therefore, these indicators have high effects on the effectiveness of other indicators. In other words, the indicators W5, W7, W9, W11, W14 and W13 are considered effects due to the negative values, hence having more affectedness. As can be seen in the table, the W6 indicator then has a longer x-intercept than other dimensions—that is, it is more significant than other indicators during their effectiveness and affectedness. As Table 3 illustrates, in the analysis of external environment of SWOT evaluation matrix, O1, O2, O3 and O8 indicators are considered as causes due to their positive values; therefore, they have high effects on the effectiveness of other indicators. In other words, the indicators O4, O5, O6 and O7 are considered to be effective due to the negative values, hence having more affectedness. The O3 indicator a longer x-intercept than other indicators--that is, it is more significant than other indicators during their effectiveness and affectedness. Moreover, among the threat indicators of the SWOT matrix, T5; T3; T4; and T2 indicators are causes due to their positive values; therefore, they have high effects on the effectiveness of other indicators. In other words, the indicators T1, T6, and T7 are effects due to the negative value, hence having more affectedness. The T4 indicator a longer x-intercept than other indicators--that is, it is more significant than other indicators during their effectiveness and affectedness.

Table 4 shows the position of the indicators based on the significance and relationship. In analysis of offensive strategy (SO), SO1, SO2 and SO4 indicators are considered to be the *cause* due to their positive values. As a result, these dimensions have high effects on the effectiveness of other indicators. In other words, SO3 and SO5 are effects due to their negative values and are more affectedness. The SO4 indicator has a longer x-intercept than other indicators--that is, it is more significant than other indicators during their effectiveness and affectedness. In addition, among the dimensions of diversity strategy (SO), ST1; ST4; and ST2 are causes due to their positive values; therefore, these dimensions have high effects on the effectiveness of other indicators. In other words, ST3 and ST5 are effects due to their negative values and more affectedness. The ST1 indicator has a longer x-intercept than other indicators--that is, it is more significant than other indicators during their effectiveness and affectedness. Moreover, in the analysis of revision strategies (WO), the indicators WO1, WO2, WO4 and WO5 are causes due to their positive values; therefore, these indicators have high effects on the effectiveness of other indicators. In other words, WO3 and WO6 are effects due to their negative values and more affectedness. The WO2 indicator has a longer x-intercept than other indicators--that is, it is more significant than other indicators during their effectiveness and affectedness. Also, among the dimensions of defensive strategies (WT), WT1; WT2; and WT3 are causes due to their positive values; therefore, they have high effects on the effectiveness of other indicators. Furthermore, WT4, WT5 and WT6 are effects due to their negative values and more affectedness. As can be seen in the table, The WT2 indicator has a longer x-intercept than other indicators--that is, it is more significant than other indicators during their effectiveness and affectedness.

Table 4
Significance and effectiveness of the four criteria of the SWOT analysis

Type of strategy	Type of relationship	Indicators	Definite numbers $(\tilde{D}_i + \tilde{R}_i)^{def}$	Definite numbers $(\tilde{D}_i - \tilde{R}_i)^{def}$	Rank
Offensive (SO)	Cause	SO1: Design and presentation of investment packages	3.656	0.405	2
	Cause	SO2: Construction, restoration, and study of historical textures with investment approach	3.562	0.356	3
	Effect	SO3: Kārūn river water tourism development	3.277	-0.148	5
	Cause	SO4: Pathology of investment in the Municipality of Ahvaz	4.067	0.886	1
	Effect	SO5: Study of investment opportunities related to Ahvaz's livability at night	3.559	-0.135	4
Diversity (ST)	Cause	ST1: Increase in the positive interaction with the executive bodies and construction of the necessary foundations with the partnership of other competent bodies to upgrade the services and perform the duties assigned to the municipality in accordance with the laws, regulations and instructions	4.461	0.978	1
	Cause	ST2: Revision of methods for attracting the cooperation of the province's investment institutions in municipal projects	4.067	0.886	3
	Effect	ST3: concluding an agreement with the Inspection Organization, Intelligence Organization, Judiciary, etc. to protect the municipality's expert decisions	3.891	-0.062	4
	Cause	ST4: Predicting an incentive system to reduce project risk	4.289	0.904	2
	Effect	ST5: providing grounds for internal trust to attract investment in The Municipality of Ahvaz Management Complex	3.773	-0.188	5
Revision (WO)	Cause	WO1: Organizing the dismissal and appointment system in the municipality and the deputy for partnerships	4.066	0.455	4
	Cause	WO2: Preparing cadastral data sources and GIS	4.338	0.573	1
	Effect	WO3: Using different methods in financing different projects and strategies of attracting investors	2.956	-0.172	5
	Cause	WO4: Approving the application of an appropriate methodology for attracting investors by emphasizing the prioritization of certain national / international brands or macro investors and capabilities in oil at the Free Zone and Kārūn region	4.079	0.46	3
	Cause	WO5: Designing an Information Bank for Investors and Urban Projects	4.234	0.467	2
	Effect	WO6: Reinforcing the appropriate partnership-based system	2.602	-0.187	6
Defensive (WT)	Cause	WT1: Revising the methods appropriate for different ways in financing and capabilities in oil at the Free Zone and Kārūn region	4.117	0.411	3
	Cause	WT2: Establishing investment facilitation working group with the partnership of municipal secretariat-related devices	4.983	0.554	1
	Cause	WT3: Identifying investment capacity related to the inherent responsibilities of the municipality	4.426	0.433	2
	Effect	WT4: Investment culturalization and information	2.704	-0.283	6
	Cause	WT5: Structural and process revision of the municipality's partnership and investment area	4.021	-0.17	4
	Effect	WT6: Revising the education system and professional qualifications of municipal employees in partnerships	3.353	-0.204	5

4. Discussion and conclusion

One of the advantages of the DEMETAL technique is its ability to determine the status of the components or characteristics of a model. This means that the structure of this technique is such that the factors or components can be categorized into two categories in terms of effectiveness and affectedness—that is, when using this technique, in addition to the possibility of prioritizing the factors, the researchers and decision makers can manage their time to address the research results and continue their work in a guided manner. This guided manner means that regarding the obtained results, whenever decision makers, depending on the subject of the research, seek to achieve early but superficial results, they can focus on the priorities in the affectedness group or effects. Now, if the goal of these decision makers is to take basic steps or focus on the essence of the issue, they can focus on the priorities in the layer of effective group or causes and formulate their plans accordingly. This issue is more accurate and valid when the technique is mixed with the fuzzy approach and provides more rational results. Regarding the sensitivity analysis of the results to the method of determining fuzzy numbers, given that in the FDEMETAL technique, internal relationships of criteria as well as strategies are considered, it can be acknowledged that the results of the fuzzy approach have a higher validity than other non-fuzzy approaches. According to the results obtained from the FDEMATEL analysis:

- Doing pathological study of investment in The Municipality of Ahvaz;
- Designing and presenting investment packages;
- Increasing positive interaction with the executive bodies and providing grounds for the necessary foundations with the partnership of other competent bodies to improve services and perform the duties assigned to the municipality in accordance with the laws, regulations, and instructions;
- Predicting an incentive system to reduce project risk;
- Preparing cadastral data sources and GIS;
- Designing a database of investors and urban projects;
- Establishing investment facilitation working group with the partnership of municipal secretariat-related devices; and
- Identifying investment capacity related to the inherent responsibilities of the municipality are as the most prioritized strategies in the development of economic partnerships in urban management of Ahvaz metropolis, respectively.

References

Albalate, D., Bel, G., & Geddes, R. R. (2015). The determinants of contractual choice for private involvement in infrastructure projects. *Public Money & Management*, *35*(1), 87-94.

Angel, Sh., Jason, P., & Daniel, l.C. (2012). *Atlas of Urban Expansion*, Cambridge: Lincoln Institute of Land Policy.

Arns, C. (2012). California: One state, two economies, *Journal of Sacramento Business*, 20 September.

Asgharpour, M.J. (2010). *Group decision-making and game theory with am operations research approach*. 2nd ed., University of Tehran Press.

Azkia, M., & Ghaffari, G. (2001). Investigating the relationship between trust and partnership in rural areas of Kashan city. *Journal of Social Sciences, 17*, Tehran.

Besada, H. (2013). *Doing business in fragile states: The private sector*, natural resources and conflict in Africa, London: James Currency Publishers.

Blacher, Y. (2005). *Changing the way Government works*, public Administration today, OCT-Dec.

Chan, A. P., Lam, P. T., Chan, D. W., Cheung, E., & Ke, Y. (2010). Potential obstacles to successful implementation of public-private partnerships in Beijing and the Hong Kong special administrative region. *Journal of Management in Engineering*, *26*(1), 30-40.

Fontela, E. (2000). Scenarios and models. *Foresight, 2*(1).

Jamshidzadeh, Ebrahim. (2003). Investigating and analyzing the costs and credits of Iranian municipalities during 1971-1977 and 1992-2000. *Quarterly Journal of Management and Planning Research, 4*(13).

Jeng, D. J. F., & Tzeng, G. H. (2012). Social influence on the use of clinical decision support systems: revisiting the unified theory of acceptance and use of technology by the fuzzy DEMATEL technique. *Computers & Industrial Engineering*, *62*(3), 819-828.

Lane, M. B. (2005). Public participation in planning: an intellectual history. *Australian Geographer*, *36*(3), 283-299.

Martin, P. (1997). *Third Millennium Management*. Bathos Press, University of South Australia.

Matuf, S. (1999). The role of people's partnership in country development planning. *Quarterly Journal of Research, Institute of Humanities and Social Sciences, Jihad Daneshgahi, 3*(1), 10-16.

Morrissey, O., & Udomkerdmongkol, M. (2012). Governance, private investment and foreign direct investment in developing countries. *World development, 40*(3), 437-445.

Nascio, L. (2006). Trend and perspective of urban public finance in developing countries. *ICFAI Journal of Urban Policy*, *3*(1).

Pejouyan, J., Mohammadpour Zarandi, H., & Danesh Jafari, D. (2011). Reforming the income and financial system of metropolitan cities. *Quarterly Journal of Urban Economics, 10*, 23-9.

Qaderi, J. (2006). Evaluation of municipal financial and revenue system in Iran. *Quarterly Journal of Economic Studies, 3*(3).

Rabiee, S., & Shahandeh, A. (2011). Development of the balanced scorecard model. *International Journal of Industrial Engineering and Production Management, 22*(1), 50-41.

Reyes, F., Cerpa, N., Candia-Véjar, A., & Bardeen, M. (2011). The optimization of success probability for software projects using genetic algorithms. *Journal of Systems and Software*, *84*(5), 775-785.

Swapan, M. S. H. (2016). Who participates and who doesn't? Adapting community participation model for developing countries. *Cities*, *53*, 70-77.

Sharzei, G.A. (2008). Recognition and analysis of sustainability of revenue items of municipalities in the country. *Quarterly Journal of Urban Management, 2*.

Taqvaee, M., & Goodarzi, M. (2016). Developing and prioritizing the formation of strategies in medical tourism (case study: Shiraz metropolis). *Journal of Urban Research and Planning, 7*(24), Spring 2016.

Tzeng, G. H., Chen, W. H., Yu, R., & Shih, M. L. (2010). Fuzzy decision maps: a generalization of the DEMATEL methods, *Soft Computing*, *14*(11), 1141–1150.

Varol, C., Ercoskun, O. Y., & Gurer, N. (2011). Local participatory mechanisms and collective actions for sustainable urban development in Turkey. *Habitat international*, *35*(1), 9-16.

Willoughby, C. (2013). How much can public private partnership really do for urban transport in developing countries?. *Research in Transportation Economics*, *40*(1), 34-55.

Yang, Y.P., Shieh, H. M., Leu, J. D., & Tzeng, G. H. (2008). A novel hybrid MCDM model combined with DEMATEL and ANP with applications, *International Journal Operational Research*, *5*(3), 160-168.

Ziari, K., Mehdi, A., & Mahdian Behnamiri, M. (2012). Studying and recognizing financial resources and providing solutions to improve the sustainability of municipal revenues (case study: municipality of Mahabad metropolis). *Quarterly Journal of Urban Management, 31*, 107-124.

Zhou, Q., Huang, W., & Zhang, Y. (2011). Identifying critical success factors in emergency management using a fuzzy DEMATEL method. *Safety Science*, *49*(2), 243-252.