

Prioritizing investment barriers in Pars Special Economic Energy Zone using the fuzzy hierarchy analytical approach (AHP)

Seyyed Yaghoob Hossainee¹ and Malihe Safari²

¹Assistant Professor Department of management,
Persian Gulf University of Bushehr,
Bushehr, Bushehr, Iran

²MA in Executive management, Marketing and Export Trend,
Bushehr Science and Research, Islamic Azad University,
Bushehr, Bushehr, Iran

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ABSTRACT: Pars Special Economic Energy Zone in Bushehr province in general and Pars Energy In particular are important areas in Iran having a young population and desirable labor force. Accessing Open Waters and being adjacent to the Persian Gulf countries, Bushehr has strategically unique and special circumstances. In fact, inability to predict future and work culture creates a structural problem in the oil and gas field of our country. The importance of the current study is to prioritize these limitations. This study aims to identify and prioritize the barriers of investments in Pars Special Economic Energy Zone, lead and attract local and foreign investment in order to enhance economic development, and eliminate inequalities while conducting regional and national social justice. Therefore, the investment barriers were identified based on literature review. Also, the viewpoints of 25 top managers in Pars Special Energy Zone were prioritized using Fuzzy Hierarchy Analysis. The results indicate that among identified factors, political factor is of the first and foremost importance. Among the indicators proposed in the conceptual model research, sub –criteria of Bank borrowing and liquidity increase with the weight of (05347/0), International sanctions against Iran with the weight of (05346/0) and inflation factor with the weight of (05321/0) were ranked first to third. And the result is exactly consistent with the current economic conditions. The importance and the effectiveness of the sub criteria on the business activities are obvious. You can follow and observe high risk of investment and the effect of nuclear activities on all national activities and decisions.

KEYWORDS: barriers to investment, fuzzy hierarchical analysis, special economic zone, prioritization.

1 INTRODUCTION

Capital is the main factor of production, economic growth, and development; hence, all countries are going to accumulate internal capital and as most developing countries lack sufficient capital, they have to attract it externally.

Investment is certainly different from capitalism in that capitalism is based on money and financial markets whereas capital is only a part of investment. Innovativeness, labor force, and technology are the other parts to be considered while investing (Salahi, 2008).

Today, we can claim that the position of every country in the world chess board is initially based on economic security, on the other hand investment growth. Thanks to the increase in world, cultural, social, political and economic security as well as demography (i.e. grounds appropriate for capital attraction) economic and political elites can reach part of the market among countries.

Prioritizing investment barriers on projects such as oil and gas on which our national economy is based has gained importance. Prioritizing investment barriers in Pars Special Economic Energy Zone (PSEEZ) is a subject responding sustainable development and the country's economic priorities from the investment perspective.

In its broader meaning, capital means economic goods that are potentially used in production of other goods or services. Studying and analyzing economic changes in the two past decades, different economic policies and inflation downturn, international sanctions, direct involvement of government in recent years and paying attention to the consequences of each era indicate un-prioritizing barriers, economic- structural problems and the country's investment in oil and gas industries and hence causing economic instability in these two industries. Now this question arises that why we can't act better or at least the same as our Qatari partner in attracting external capital for PSEEZ.

There is no doubt that continuing the past trend cannot afford the necessities and priorities of the country's economy from the viewpoint of both internal and external investment. Investment is important when it comes to a close relation with national interests of investor and large multinational countries for they are widely located all over the world.

While there is an increase on investment in other countries, unfortunately Iran has faced a severe challenge on the part of investment. The reasons include: lack of strategic thoughts, not using previous research results, lack of coherent planning and management. So, the current research aims not only to recognize the investment barriers in PSEEZ, but also to prioritize them using Fuzzy Hierarchical Analysis Approach (AHP) and present a final model.

2 THEORETICAL REVIEW OF LITERATURE

2.1 CAPITAL AND ITS DEFINITIONS

According to international economy, transferring capital and investment in other countries is part of nations' economic relations and it is different from world trading. That's why researchers of this field study and evaluate cross countries capital flow on capital inflow theory to benefit their hypothesis and special definitions. It is worth noting that capital inflow doesn't just present capital flow, it also considers capital transferring flow, motives, reasons, and the effects of political liberties and restrictions about that.

This theory investigates interest-orientation and capital turn-over theory using capital flow theory. Balance of payment in a country is resulted when the amount of declared flows equals its relative payments. We summarized capital flow-based research as follow (Mahdavi, 2005):

Based on historical statistical, United states has done its oldest foreign investment research between 1850 - 1918. Capital flow trend between two world wars was along resulted in significant international investment of United States so that in 1919, its international investment reached to \$6.5 billion and enhanced to \$8.3 billion the following year which includes two third of the whole international investment. This figure will exceed \$15.7 billion by 1930.

Capital flow had a significant increase after 1945. Considering rapid growth of investment and its diversity in the world, nowadays capital flow theory and its limited hypothesis don't qualitatively and quantitatively support capital flow in the world. These employers knew almost everything about their jobs and decided on everything. It continued until early 20th century. By the rapid economic growth in United States and the start of enterprises integration, the new approach of continental marketing production and vertical integration of firms needed a new management. Therefore, family enterprises which were under exact monitoring of few people were replaced by enterprise management pyramid. Through it, capital gained power and working platform, coordination scope was knowingly extended, market-based labor division sector was limited, organic management system was established and a modern firm was constituted.

Organizations were developed soon. For example, the problem of mass production in United States was simply solved by the first decade of 20th century. By the late 19th century, scientists and engineers reached almost all inventions necessary for mass production of all basic consumption goods with less cost (Mahdavi, 2005).

Multinational countries gradually developed after worldwide II and started working all over the world. It is worth noting that large multinational companies were mainly established in Europe and America and started working worldwide. The majority of large multinational companies are centralized in America, Germany, and England respectively.

2.2 DEFINITION OF INVESTMENT

The investment in our country comparing with that of some countries in Middle East, especially countries of East Asia and the whole world has had a slow growth and has become vulnerable. Specifically, investment occurs in different ways

depending on social, cultural, political and economic conditions of the country. Economists have presented different points of view on investment classification.

Investment means the act of committing a current value, which is usually known, with the expectation of obtaining an additional value, which is usually unknown, in the future. In fact, ignoring today usage is done in the hope of using more in the future (M. Jahromi, 2009).

In a broader meaning, investment is an economic good which potentially produces another economic good such as cash, factory, machinery and its components, tools, patent, technical services, etc.

Indeed, capital is in three formats: physical capital including equipment and machineries, financial capital including securities and stocks, and human capital including technical knowledge and education. To develop and continue economic growth, different viewpoints emphasize on investment in different abovementioned grounds (Mahdavi, 2005).

3 STUDYING INVESTMENT BARRIERS IN IRAN

Most developing countries face shortage of investment sources when prospering economic conditions, job creating, and achieving economic sustainable development and growth. Reasons which limit saving sources interchangeable to productive investments include: export-based-exchange income deficiency, unfair transactional rate which usually harms exporters of goods and raw materials, mass population and hence high consumption. Countervailing economic backwardness and achieving sustainable development require investment in order to benefit relative advantages and potential economic capabilities. Capital, in globalization process is easily transferred. However, investors are trying to gain more benefits and reach a safe place to investment. Investment saturation in developed industrial countries caused the decline in the rate of return on investment in these countries and investors are always seeking to benefit opportunities with greater efficiency. If the investment security in developing countries and economies in transition are guaranteed and the necessary legal platform is provided, international investors are more willing to attend in these markets. This is also an opportunity for host countries to benefit from the relative advantages, economic growth, job creation and access to modern knowledge and technology to produce competitive products in the international arena. Therefore, accelerating the entry of foreign investments would bring mutual benefit for both the host countries and international investors

Barriers to investment in economic, political, and cultural, social and legal sector include:

3.1 ECONOMIC BARRIERS

The complexity of the business - economic system is so that multiple sectors must be considered and inefficiency of each of these sectors is certainly a major barrier to investment attraction. Some economic barriers to foreign investment attraction are as follow:

Lack of clear and consistent strategy in exchange and monetary policy ,constant changes and sectional decisions in the banking sector, uncertainty of the exchange and fluctuation of its rate, inflation, bank borrowing and liquid it yin crease, interest rate and its changes, problems of customs regulations, lack of financial institutions and efficient stock, problems resulting from the government's activities in the economy, uncertainty of privatization policy, problems of law enforcement practices, inefficiency of trade regulations, investment high risk, inequities in wealth distribution, over expanding public sector, inefficient trade policies, lack of physical infrastructures, ports weakness, lack of incentives, lack of adequate skilled manpower, and confined Iranian economy.

Inadequate economic infrastructure development is another factor threatening foreign investment. For the foreign investors work successfully in the country, appropriate economic infrastructures relative to their activities are required. Foreign companies cannot work without accessing these infrastructures. For instance, we can refer to infrastructure weakness of two systems of communications and transportation (Behkish, 2001). Exchange fluctuation is one of the main economic risks of foreign investment in the country. Recently, the government has performed monetary reforms in order to provide security in the national financial market. However, foreign investors are exposed to loss if exchanges especially dollar fluctuate a lot. This will happen when the dollar will soar.

Another barrier to investment is lack of or poor economic management which is not able to manage the changes timely and eliminate them. This type of management faces deficiency of knowledge, experience and competence and does not consider achieving assessed approaches as its own responsibility. They also suggest that foreign investors will make the competitive market unequal, create monopoly and hence the community goes toward unnecessary consumption. They also

argue that the foreign investors do not care about people of a country in which they have invested and instead, they just think about their profitability (www.sarmayeh.net).

3.2 POLITICAL BARRIERS

Despite its economic importance in accumulating capital, investment has several political consequences. Today, countries which try to attract and support foreign capital through applying a public policy are considered internationally different; because, foreign investment attraction requires political stability. Since appropriate political conditions for foreign investors are somehow prior to other conditions, it can be inferred that the main political barriers to foreign investment include: international sanctions against Iran, lack of internal consensus on how to attract foreign investment, political instability, relatively high political risk, security problems, international political positioning in relation to global issues such as Syria's issues and adverse foreign media publicity about Iran.

Iran is in a complex condition due to its governmental structure and relations with other countries; therefore, any changes concerning internal and foreign conditions can easily affect Iran's economic conditions and hence foreign investment. Ideal theoretical and ideological dominance of the government is considered as a high political risk factor in Iran. Iran's political tension relations with other countries have influenced the country's economic conditions and hence foreign investment. It is so important that any increase or decrease in the tension will clearly affect demands and foreign investment activities in the country.

Nuclear activities are considered the main crisis of foreign political affairs in Iran. If Iran is limitedly sanctioned by Security Council, this sanction can be in different areas affecting foreign investment in Iran both directly and indirectly (www.sarmayeh.net).

Iran has been long accused of interfering with South West Asian countries' affairs specially Syria's and hence preventing American supported countries to be established. In consistent with the above discussion we can refer to recent oral conflicts between Iran and America where both nations accused each other of doing subversive activities against each other's interests (in Iran and Syria). So, Iran has indirectly imposed some restrictions on his mutual business transactions and some business programs have been eliminated.

The last issue we consider here is respecting human rights by Iran. It occasionally causes tension in the relationships between Iran and western countries, especially Europe and Canada. These countries tend to condemn Iran by expressing its offences before international organizations and hence blurring Iran's international outlook (A. Shahid).

3.3 SOCIAL AND CULTURAL BARRIERS

Culture is the communication and human foundation of any society. Indeed, human social behaviors root back in the culture which is embedded in him. Social culture of any society is the main criterion defining how to communicate with other communities. Culture in its broadest sense is what we call communication and social interaction.

Belief and negative feelings towards investment and foreign capital has always induced a false impression. This feeling, especially in the Third World countries, is influenced by people who generally prefer state economy to free economy. The experience of growth and development of developed countries in the recent three decades show that this notion is not consistent with rational criteria and real applications. In the past three decades, the world has witnessed countries which have change to a power through investment continuation. These countries have accepted the market economic frameworks and gradually included themselves among developed countries and hence making themselves more and more away from economic backwardness and poverty. Cultural barriers to investment briefly include :Having negative feelings toward foreigners, foreign investors' suspicion about investment in Iran, poor communication and interaction with foreign investors, government-destructive propaganda, inappropriate publicity and lack of worldwide confidence-building, types of communication and social norms, lack of appropriate educational facilities such as bilingual schools, cultural restrictions, and the problems concerning social security (Rafati , 2009).

4 RESEARCH BACKGROUND

Valiollah Karimi (1997) investigated the barriers to investment in Kish Free Zone (KFZ) in his study. In this study, by investment he meant investment by both domestic and foreign investors. Barriers to investment attraction mean any factor negative ly influencing the beginning and development of investment in KFZ (Karimi, 1997).

The results show that investment requires necessary ground and infrastructures and if they are not provided, investment would not happen. Therefore, lack of some factors effective in investment is considered as barriers to attract capital.

Behrang Samadi (2000) in his research "*Problem and barriers to foreign investment in Iranian infrastructural industries (oil industry)*" states that using foreign investment in Iranian infrastructural industries is on the lips of most economic-meeting members. He also emphasizes on foreign investment in Iran's oil industry. However, Iran's oil industry has not worked well attracting foreign investors and it seems there are some barriers to this end (samadi, 2000).

Soheil Poor haji (2001) has studied the effect of direct foreign investment on host country's macroeconomic variables (comparative study of selected countries: China, Chili, Iran). He has performed a comparative study (studying the effect of direct foreign investment in different countries) using historical data and econometrics approach. Poor Haji collected his data through library study and statistical sources. On the other side, he rarely investigated the effect of foreign investment on host country's economy as he considers the effect of policy more than that of the other variables (P. H.Hosseini, 2001).

Molouk Partovi Shafagh (2003) has studied approaches to attract foreign investment in Iran. Systematically investigating Iranian political and economic criteria and its worldwide interaction in recent decade, she identified Iran's reconstruction challenges and presented efficient approaches to eliminate barriers to investment attraction (P. Shafagh, 2008).

Mitra Nedayi (2005) has investigated the effect of direct foreign investment on technology transfer (comparative study). In her study, Nedayi used Correlation coefficient test and Engle-Granger Causality test. The results show that foreign investment deficiency and technological gap have made Iran unsuccessful in globalization process despite having abundant available sources and advantages. She has also compared the effect of investment on Iranian technology sector with other countries like Malaysia (Nedayi, 2005).

Hossein Dastar (2009) has worked on problems and barriers to attract foreign investment in Pars Special Economic-Energy Zone (PSEEZ). He has investigated and prioritized barriers to foreign investment in PSEEZ using T-student test, Chi-Square test and Friedman test. Then, he prioritized analyzed data and finally introduced political barriers as the main ones (Dastar, 2009).

Mehrnoosh Akbari (2010) studied economic security and its effect on investment in Iran. She has used analytical-historical method in order to investigate economic security and its effect on investment in Iran during the country's cultural, social and economic programs (Akbari, 2010). The results indicate a positive relation between investment growth and economic development and security.

Based on the discussed model it can be inferred that the more economic freedom, the more effect the direct foreign investment will have on gross domestic product, implying a direct relationship between presented variables.

Somayyeh Asadi (2010) has researched about investment's aptitude and relative advantages in East Azerbaijan. She has used an analytical approach and collected her data using library studying, data and statistical observations. Asadi ranked and prioritized each industrial activity using LQ criterion, RCA criterion and Numerical Taxonomy method with some efficient criteria. She then compared the province's industrial activity with other state industries.

The results indicate that machinery and metal equipment, food industries, textile industries, nonmetal mineral industries and chemical industries were of significant relative advantage in production and exportation comparing with the country (Asadi, 2010).

Sepide Samimi (2010) has investigated the effect of oil incomes on Iranian industrial structures using three criteria of added value, investment and employment. In her research, she used regression and library data collection. The results imply that oil income has dissimilated effects on various industrial activities (Samimi, 2010).

Tahmineh Rahmani (2010) carried out the research "*On the influence of joint venture contract on Iran's administrative laws*" using inferential-descriptive method and library data. The main consequence of the research is that despite financing strategy, borrowing foreign sources and applying direct investment in domestic private sector make no commitment to the government. This is economic efficiency of investment arising from wise selection which creates interest for partners (Rahmani, 2010).

Maryam S. Ehsani Tabatabai (2011) investigated the effect of organizational investors on investment policies of the firms. Correlation method and multivariable regression was used in this study. The result shows a positive relationship between organizational investors and investment policies (Tabatabai, 2011).

Mohsen Klich (2011) conducted the research "*Casual relationship between economic growth and foreign investment growth in provinces of Iran*" using library method. The required statistics were collected from Statistical Center of Iran,

Investment Organization, and Central bank Time Series. The researcher used Granger Causality test, Hsiao Causality test, and FPE standard. The results show that there is a casual and mutual relationship between economic growth and foreign investment growth in provinces of Iran (Klich, 2011).

Nima Nasrollahi Shahri (2010) has conducted the research *“The Petroleum Legal Framework of Iran”* using analytical-historical approach. The results reveal that attracting more capital in Iran’s petroleum sector requires some changes in the current laws of oil industry. The researcher suggests that reforming international political attitude can complement the notion of applying energy sources (Nasrollahi Shahri, 2010).

Quan Li and Guoyong Liang (2012) investigated the political relations and Chinese outbound direct investment using survey-descriptive method. They believe Chinese firms tend to invest in countries with high political risks. That’s why economists and Chinese elites consider the role of inter-state political relations and international political issues significantly important regarding outbound direct investment and foreign direct investment as well. The research consists of two tests: one at the firm level and the other at the dyadic level (Quan &Guoyong, 2012).

Dola Kamariah, Tahir Osman Mohd and Omid Reza Saadatian (2010) conducted a research on *“Identifying Challenges in Implementing Sustainable Practices in a Developing Nation”*. This paper employs survey, interview as well as observation to explore the perception of people on planning and sustainable development efforts and to identify the most important challenges at Pars Special Economic Energy Zone. The result shows that the major impediment against sustainability is the environment and the cultural barriers are the second (Kamariah, Osman and Saadatian, 2010).

5 RESEARCH METHODOLOGY

This study is survey-descriptive with a quantitative approach. Prioritizing investment barriers in PSEEZ which is studied in this research is one of the key and challenging issues in strategic planning. The final aim of the research is to identify and prioritize investment barriers in active agencies located in Asaluye Special Economic Zone. You can see the investment barriers in Figure 1.

5.1 FUZZY HIERARCHICAL ANALYSIS APPROACH

Fuzzy hierarchical analysis (AHP) process is a research technique supporting multifactor logical decisions. This technique is a prominent managerial tool for complicated decision-making problems. It is also used as a method for solving qualitative and quantitative problems (Lee, Kim, Kim and Oh, 2012).

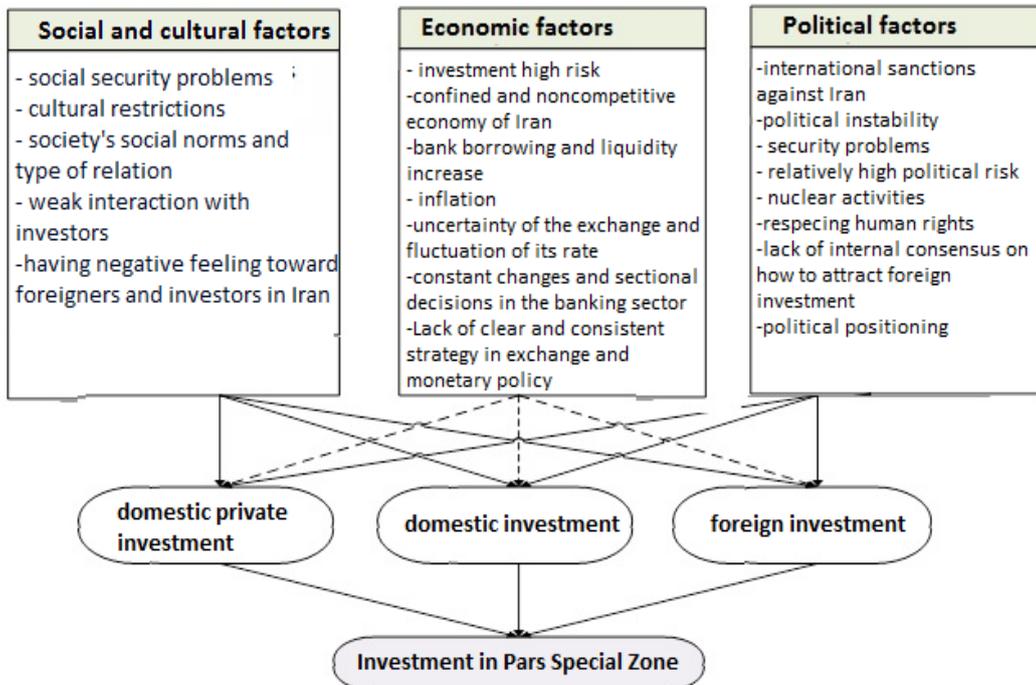


Fig. 1. Barriers to investment

Fuzzy notion in AHP approach is considered indirectly and without using fuzzy sets. In this method, in fact, we used linguistic expressions (shown in Table 2) in order to determine Pair wise Comparison Matrices. Therefore, by generalizing the above method, approaches are presented in which fuzzy numbers are used to determine the priority of each factor. Meanwhile we can refer to methods presented by Chang (Chang, 1992). Broader investigations concerning these techniques are seen in research by Kahraman et al. (Kahraman, Cebeci & Ruan, 2004). Here, fuzzy AHP is used as Chang’s extent analysis method.

Table 1. Membership function of linguistic variables determining criteria weights

Priority of column over row				Priority of row over column			
Linguistic variable	Equivalent fuzzy number			Linguistic variable	Equivalent fuzzy number		
Equally important	1	1	1	Equally important	1	1	1
Equally to Weakly important	2.67	2	1.33	Equally to Weakly important	0.75	0.5	0.37
Weakly important	3.67	3	2.33	Weakly important	0.43	0.33	0.27
Weakly to very important	4.67	4	3.33	Weakly to very important	0.30	0.25	0.21
very important	5.67	5	4.33	very important	0.23	0.20	0.18

5.2 STAGES OF FUZZY AHP

In this approach, for each row of pair wise comparison matrix, SK which is a triangular fuzzy number is calculated as below (Azar and Faraji, 2008):

Let $X=\{x_1,x_2,x_3,\dots,x_n\}$ be an object set and $U=\{u_1,u_2,\dots,u_n\}$ as a goal set. Then, According to the method of Chang’s extent analysis, each object is taken and the extent analysis for each goal, (g_i) is performed respectively. Therefore, m extent analysis values for each object can be obtained, with the following signs:

$$M_{g_i}^1, M_{g_i}^2, \dots, M_{g_i}^m \quad i=1, 2, 3 \dots n$$

$$\begin{bmatrix} M_{g_1}^1 & M_{g_1}^2 & \dots & M_{g_1}^m \\ M_{g_2}^1 & M_{g_2}^2 & \dots & M_{g_2}^m \\ \dots & \dots & \dots & \dots \\ M_{g_n}^1 & M_{g_n}^2 & \dots & M_{g_n}^m \end{bmatrix}$$

Where all $M_{g_i}^j$ are triangular fuzzy numbers presented as (l, m, u) . The steps of extent analysis can be given as follow:

Step 1: Obtaining fuzzy synthetic extent for each object

Let $M_{g_i}^1, M_{g_i}^2, \dots, M_{g_i}^m$ be the ith object extent analysis for m goals. Then, the extent synthetic analysis of m goals for ith object is defined as:

Let $M_{g_i}^j = (l_{ij}, m_{ij}, u_{ij})$. Then, $\sum_{j=1}^m M_{g_i}^j$ is defined by fuzzy addition operation of m extent analysis values as follow:

$$\sum_{j=1}^m M_{g_i}^j = (l_{i1}, m_{i1}, u_{i1}) + (l_{i2}, m_{i2}, u_{i2}) + \dots + (l_{im}, m_{im}, u_{im}) = \left(\sum_{j=1}^m l_{ij}, \sum_{j=1}^m m_{ij}, \sum_{j=1}^m u_{ij} \right) = (l'_i, m'_i, u'_i)$$

To obtain $\left[\sum_{i=1}^n \sum_{j=1}^m M_{g_i}^j \right]^{-1}$ by fuzzy addition operation we will have:

$$\sum \sum M_{g_i}^j = \sum_{i=1}^n \left(\sum_{j=1}^m l_{ij}, \sum_{j=1}^m m_{ij}, \sum_{j=1}^m u_{ij} \right) = \left(\sum_{i=1}^n l'_i, \sum_{i=1}^n m'_i, \sum_{i=1}^n u'_i \right)$$

$$\left(\sum_{i=1}^n \sum_{j=1}^m M_{g_i}^j \right)^{-1} = \left(\frac{1}{\sum_{i=1}^n u'_i}, \frac{1}{\sum_{i=1}^n m'_i}, \frac{1}{\sum_{i=1}^n l'_i} \right)$$

$$S_i = \sum_{j=1}^m M_{g_i}^j * \left[\sum_{i=1}^n \sum_{j=1}^m M_{g_i}^j \right]^{-1}$$

And hence:

$$(l'_i, m'_i, u'_i) * \left(\frac{1}{\sum_{i=1}^n u'_i}, \frac{1}{\sum_{i=1}^n m'_i}, \frac{1}{\sum_{i=1}^n l'_i} \right) = \left(\frac{l'_i}{\sum_{i=1}^n u'_i}, \frac{m'_i}{\sum_{i=1}^n m'_i}, \frac{u'_i}{\sum_{i=1}^n l'_i} \right) = (l_i, m_i, u_i)$$

$$(1)S_k = \sum_{j=1}^n M_{ij} \otimes \left[\sum_{i=1}^m \sum_{j=1}^n M_{ij} \right]^{-1}$$

Where k is the raw number and i and j represent items and criteria respectively.

Step 2: In this method, after computing S_k s, their greatness should be obtained with respect to each other. M_1 and M_2 are generally two triangular fuzzy numbers. M_1 and M_2 are defined as follow:

$$(2) \quad V(M_i \geq M_k) = 1 \quad \text{if } m_i \geq m_k$$

Other wise

$$V(M_i < M_k) = \text{hgt}(M_i \cap M_k)$$

and we have:

$$(3) \quad \text{hgt} = (M_i \cap M_k) = \frac{U_i - L_k}{(U_i - L_k) + (m_k - m_i)}$$

Step 3:The degree of possibility for a triangular fuzzy number to be greater than k triangular fuzzy numbers can be defined by:

$$(4) \quad V(M_1 \geq M_2, \dots, M_k) = V(M_1 \geq M_2) \text{and } \dots \text{and } V(M_1 \geq M_k)$$

Do as follow to obtain criteria weights in pair-wise comparison matrix:

$$(5) \quad w'(x_i) = \min \{V(S_i \geq S_k)\} \quad k = 1, 2, 3, \dots, n, k \neq i$$

Step 4:Therefore, the weight vector is given by

$$(6) \quad w'(x_i) = [w'(x_1), w'(x_2), \dots, w'(x_n)]^t$$

This is the unnormalized coefficient vector .To obtain the normalized vector:

$$(7) \quad w(x_k) = \frac{w'(x_k)}{\sum_{k=1}^n w'(x_k)}$$

These steps have been done for all pair-wise comparison tables in order to obtain normalized weights.

6 RESEARCH RESULTS

Figure 2 illustrates barriers to investment as a research operational model or research decision tree. At first the research native and implicit model, which is the result of previous valid sources and interviews with elites, are presented and then fuzzy AHP with an extent approach is implemented.

As we mentioned above, investment barriers in PSEEZ include: 1. social and cultural barriers; 2. Economic barriers; 3. Political barriers. All these three criteria have various sub-criteria which are illustrated as decision tree in the following graph:

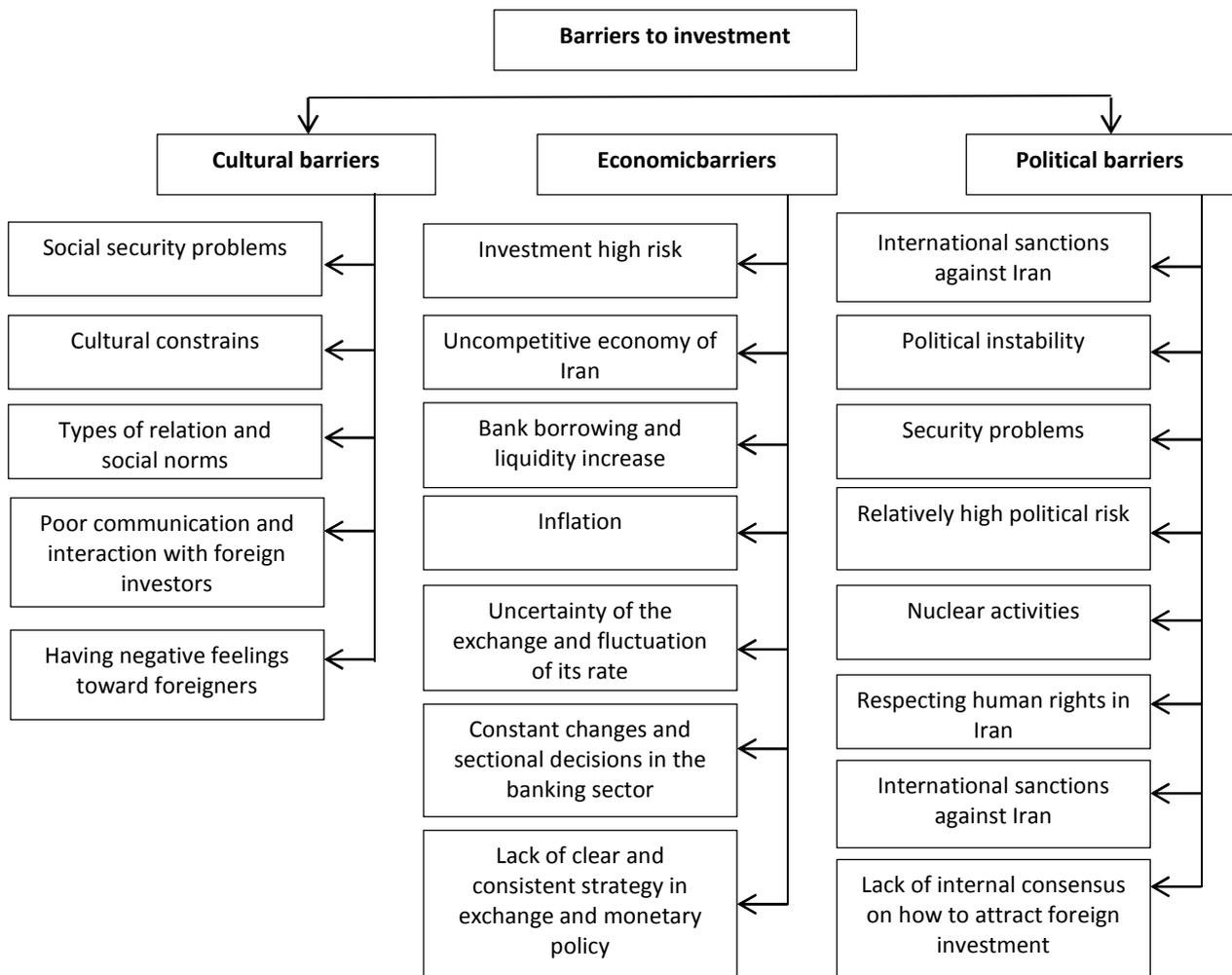


Fig 2 : Decision tree for prioritizing investment barriers

Before implementing fuzzy AHP with Chang extent approach, it is worth noting that in the present study, we used group decision-making process. The results are from 25 questioners filled by elites, managers and supervisors of ASEZO in province Bushehr.

Here, we prioritize 8 sub-criteria of political barriers (international sanctions against Iran, security problems, political instability, relatively high political risk, nuclear activities, respecting human rights in Iran, lack of internal consensus on how to attract foreign investment, political positioning). To do so we first represented a fuzzy group decision making table concerning pair-wise comparison of 8 mentioned sub-criteria. To calculate the inconsistency rate of this matrix, we should first change fuzzy numbers into crisp numbers. You can see fuzzy AHP pair-wise comparison matrix in the following table. This matrix is the result of geometric mean of experts' opinions regarding prioritization of political barriers. In this table, for the values below the main diameter we used the reversed values for those above the diameter. All the steps toward obtaining the weight of each sub-criterion is illustrated in table 2.

Table 2: Pairwise comparison matrix for political barriers

	C1	C2	C3	C4
C1	(1,1,1)	(1.4461, 1.7241, 2.0178)	(1.7766, 2.2089, 2.6643)	1.1424, 1.4102, 1.6974)
C2	(0.4955, 0.5799, 0.6914)	(1,1,1)	(1.3191,1.6485, 2.0003)	(1.0852, 1.3005, 1.5162)
C3	(0.3753,0.4527, 0.5628)	(0.4999, 0.6065, 0.7580)	(1,1,1)	(0.4944, 0.5905, 0.7213)
C4	(0.5891, 0.709, 0.8753)	(0.6595, 0.7689, 0.9214)	(1.3863,1.6932, 2.0223)	(1,1,1)
C5	(0.6214, 0.7424,0.898)	(1.0067, 1.2312, 1.4848)	(1.8560,2.2658, 2.6980)	(1.232, 1.467, 1.7414)
C6	(0.5592,0.6561, 0.7868)	(0.6326, 0.7491, 0.9045)	(1.0584, 1.2866,1.5711)	(0.5093, 0.6047, 0.7366)
C7	(0.7784, 0.9363, 1.1182)	(0.7854, 0.9504, 1.1510)	(1.0199,1.2343, 1.4801)	(0.9269, 1.1619,1.4436)
C8	(1.1491,1.3922, 1.6799)	(1.1670, 1.4522, 1.776)	(1.3394, 1.6031, 1.9054)	(1.2935, 1.5722, 1.8905)
	C5	C6	C7	C8
C1	(1.1134, 1.3468,1.609)	(1.2708,1.5241, 1.7881)	(0.8942, 1.0679, 1.2846)	(0.5952, 0.7182, 0.8701)
C2	(0.6734, 0.8121,0.9933)	(1.1054, 1.3349, 1.5806)	(0.8687, 1.0521, 1.2731)	(0.563, 0.6885, 0.8568)
C3	(0.3706, 0.4413, 0.5387)	(0.6364, 0.7772,0.9447)	(0.6755, 0.8101, 0.9804)	(0.5248, 0.6237, 0.7465)
C4	(0.5742,0.6816, 0.8116)	(1.3575,1.6535, 1.9634)	(0.6927, 0.8606, 1.0787)	(0.5289, 0.636, 0.773)
C5	(1,1,1)	(1.5534,1.8544, 2.1832)	(1.2512, 1.522, 1.837)	(0.8356, 1.0477, 1.2922)
C6	(0.458,0.5392, 0.6437)	(1,1,1)	(0.5458, 0.6629, 0.8051)	(0.5185, 0.6087, 0.7283)
C7	(0.5441, 0.6569, 0.7992)	(1.242, 1.5082, 1.8321)	(1,1,1)	(0.6697, 0.8125, 0.9999)
C8	(0.7738, 0.9544, 1.1967)	(1.3729, 1.6426, 1.9283)	(1.000019, 1.2307, 1.4929)	(1,1,1)

Then, based on EA method, SK which is a triangular fuzzy number is computed for each row of matrix as follow:

$$\sum_{j=1}^8 M_{g_1}^j = (1,1,1) + (1.4461,1.7241, 2.01786) + (1.7766, 2.2089, 2.6643) + (1.1424, 1.4102, 1.6974) + (1.1134, 1.3468, 1.6090) + (1.2708, 1.5241, 1.7881) + (0.8942, 1.0679, 1.2846) + (0.5952, 0.7182, 0.8701) = (9.2390, 11.0006, 12.9318)$$

$$\sum_{j=1}^8 M_{g_2}^j = (7.11, 8.4169, 9.912) \quad \sum_{j=1}^8 M_{g_3}^j = (4.5772, 5.3023, 6.2528)$$

$$\sum_{j=1}^8 M_{g_4}^j = (6.788, 8.0030, 9.446) \quad \sum_{j=1}^8 M_{g_5}^j = (9.356, 11.130, 13.135)$$

$$\sum_{j=1}^8 M_{g_6}^j = (5.282, 6.107, 7.176) \quad \sum_{j=1}^8 M_{g_7}^j = (6.966, 8.260, 9.824)$$

$$\sum_{j=1}^8 M_{g_8}^j = (9.096, 10.8479, 12.869)$$

$$\sum_{i=1}^8 \sum_{j=1}^8 M_{g_i}^j = (58.417, 69.07, 81.549) \quad \left(\sum_{i=1}^8 \sum_{j=1}^8 M_{g_i}^j \right)^{-1} = (0.0122, 0.0144, 0.0171)$$

- S₁=(0.113294, 0.159267, 0.22137) S₂=(0.087197, 0.12186, 0.16967)
- S₃=(0.056128, 0.076767, 0.107038) S₄=(0.083243, 0.115869, 0.1617)
- S₅=(0.114736, 0.161152, 0.224862) S₆=(0.064771, 0.088427, 0.122849)
- S₇=(0.08543, 0.119602, 0.168178) S₇=(0.11154, 0.157056, 0.220311)

Then, the greatness degree of each SK is computed with respect to others. The greatness value, $V(S_i \geq S_k)$ of each SK is presented below:

$$V(S_1 \geq S_2, \dots, S_8) = \text{Min}(V(S_1 \geq S_2), \dots, V(S_1 \geq S_8)) = 0.9175$$

$$V(S_3 \geq S_1, \dots, S_8) = \text{Min}(V(S_3 \geq S_1), \dots, V(S_3 \geq S_8)) = 1.011659$$

$$V(S_5 \geq S_1, \dots, S_8) = \text{Min}(V(S_5 \geq S_1), \dots, V(S_5 \geq S_8)) = 0.915615$$

$$V(S_7 \geq S_1, \dots, S_8) = \text{Min}(V(S_7 \geq S_1), \dots, V(S_7 \geq S_8)) = 0.957165$$

$$V(S_2 \geq S_1, \dots, S_8) = \text{Min}(V(S_2 \geq S_1), \dots, V(S_2 \geq S_8)) = 0.9549$$

$$V(S_4 \geq S_1, \dots, S_8) = \text{Min}(V(S_4 \geq S_1), \dots, V(S_4 \geq S_8)) = 0.96089$$

$$V(S_6 \geq S_1, \dots, S_8) = \text{Min}(V(S_6 \geq S_1), \dots, V(S_6 \geq S_8)) = 0.988341$$

$$V(S_8 \geq S_1, \dots, S_7) = \text{Min}(V(S_8 \geq S_1), \dots, V(S_8 \geq S_7)) = 0.919712$$

$W' = (0.9175, 0.954, 1.0117, 0.9609, 0.9156, 0.9883, 0.9572, 0.9197)$
$W_N = (0.1203, 0.1252, 0.1327, 0.126, 0.1201, 0.1296, 0.1255, 0.1206)$

The result of applying fuzzy AHP method is illustrated in table 3:

Table 3: Final prioritization of political barriers sub-criteria

Political barriers	Abb	The degree of importance resulted from applying fuzzy AHP	Rank with respect to the degree of importance
<i>Lack of internal consensus on how to attract foreign investment</i>	C ₁	0.1203	7
<i>Political instability</i>	C ₂	0.1252	5
<i>International sanctions against Iran</i>	C ₃	0.1327	1
<i>Political positioning</i>	C ₄	0.126	3
<i>Respecting human rights in Iran</i>	C ₅	0.1201	8
<i>Nuclear activities</i>	C ₆	0.1296	2
<i>Relatively high political risk</i>	C ₇	0.1255	4
<i>Security problems</i>	C ₈	0.1206	6
Consistency rate		0.0456	

To obtain consistency rate, we should first change fuzzy matrix into defuzzy or crisp matrix that is by formula mentioned in the last section we should change all fuzzy numbers into crisp numbers. Dufuzzied numbers related to political barriers sub-criteria are shown in table 4.

Table 4: Dufuzzied numbers related to political barriers sub-criteria

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8
C_1	1.0000	2.1105	2.8085	1.7868	1.6869	1.8726	1.3425	0.9112
C_2	0.7196	1.0000	2.1101	1.5880	1.0396	1.6571	1.3343	0.8987
C_3	0.5887	0.7936	1.0000	0.7534	0.5623	0.9917	1.0253	0.7795
C_4	0.9153	0.9579	2.1247	1.0000	0.8474	2.0621	1.1347	0.8088
C_5	0.9384	1.5597	2.8346	1.8198	1.0000	2.2836	1.9281	1.3629
C_6	0.8192	0.9434	1.6473	0.7684	0.6708	1.0000	0.8442	0.7584
C_7	1.1709	1.2060	1.5517	1.5219	0.8368	1.9209	1.0000	1.0476
C_8	1.7610	1.8711	1.9933	1.9834	1.2569	2.0182	1.5699	1.0000
CI=0.0456								

As it is shown in table 4, consistency rate of political barriers is 0.0456 which is less than 0.1. Therefore, it can be inferred that the answers are of acceptable consistency.

Eight major sub-criteria related to political barriers which are represented here are considered the investment barriers in active enterprises of the oil and gas sectors; hence, they should be paid high attention. C_3 (international sanctions against Iran), among other sub-criteria, with the approximate weight of 0.132 is in first importance rank. Then, C_6 (nuclear activities) with the weight of 0.129 is in the second rank. As it goes, C_5 (respecting human rights in Iran) with the weight of 0.1200 is in the last rank.

It should be noted that the main political criterion to which these 8 sub-criteria belong has the first priority to senior managers of ASEZ and hence special attention to these sub-criteria is of great importance.

We did the same for economic and cultural sub-criteria as we did for political ones. However, the results are not shown here according to the author. The final weights for economic barriers, however, are shown in table 5.

Table 5: ranking economic barriers

Economic barriers	Abb	The degree of importance resulted from applying fuzzy AHP	Rank with respect to the degree of importance
<i>Inflation</i>	B_1	0.1473	2
<i>Uncompetitive economy of Iran</i>	B_2	0.1391	7
<i>Bank borrowing and liquidity increase</i>	B_3	0.14802	1
<i>Investment high risk</i>	B_4	0.14061	5
<i>Uncertainty of the exchange and fluctuation of its rate</i>	B_5	0.1418	4
<i>Constant changes and sectional decisions in the banking sector</i>	B_6	0.14058	6
<i>Lack of clear and consistent strategy in exchange and monetary policy</i>	B_7	0.1424	3
Consistency rate		CI=0.0987	

Among 7 economic sub-criteria, bank borrowing and liquidity increase (B_3) with the weight of 0.148 was in the first importance rank. Then, inflation (B_1) with the weight of 0.147 was in the second rank. Similarly, uncompetitive economy of Iran (B_2) with the weight of 0.139 was in the last rank. Generally speaking, these 7 sub-criteria should be paid economic attention by politicians and senior managers of Pars oil and gas sector.

Table 6: Final ranking of cultural and social barriers

Social and cultural barriers	Abb	The degree of importance resulted from applying fuzzy AHP	Rank with respect to the degree of importance
Social security problems	A ₁	0.216	1
Cultural constrains	A ₂	0.201	3
Types of relation and social norms	A ₃	0.205	2
Poor interaction with foreign investors	A ₄	0.187	5
Having negative feelings toward foreigners	A ₅	0.191	4
Consistency rate		CI=0.0798	

Table 6 shows sub-criteria weights of social and cultural barriers. The table consists 5 major sub-criteria of social and cultural factors which are barriers to investment in active enterprises of oil and gas sectors. Among these sub-criteria, factor of “social security problems” (A1) with the weight of 0.216 is in the first rank. Then, “types of relation and social norms” (A3) with the weight of 0.205 is in the second rank and similarly “having negative feelings toward foreigners” (A4) with the weight of 0.187 is in the last rank. Generally speaking, these 5 sub-criteria should be paid economic attention by politicians and senior managers of Pars oil and gas sector. Final ranking of three major barriers is illustrated in table 7.

Table 7: Ranking of major barriers

Major barriers	Abb	The degree of importance resulted from applying fuzzy AHP	Rank with respect to the degree of importance
Social and cultural barriers	K ₁	0.2356	3
Economic barriers	K ₂	0.3613	2
Political barriers	K ₃	0.4029	1
Consistency rate		CI=0.0439	

Among these three investment barriers, political factor with the approximate weight of 0.4029 is in the first rank. Then, economic and social and cultural factors with the weights of 0.3613 and 0.2356 are in the second and last rank, respectively. In a broader view, politicians and senior managers of Pars oil and gas sectors should pay a special attention to these three factors.

WEIGHTING AND PRIORITIZING ALL ASPECTS OF RESEARCH CONCEPTUAL MODEL

After calculating the weights of all major criteria and their sub-criteria, it is possible to weight and prioritize all aspects of model. To obtain the final prioritization of sub-criteria, we multiplied the weight of each sub-criterion by the weight of its respective major criterion to reach the final weight of each sub-criterion. The following table shows the final weight of each sub-criterion.

Table 8: Prioritization of sub-criteria related to all investment barriers in active enterprises of oil and gas sectors

Major criteria	Criteria weight	rank	sub-criteria	Sub-criterion weight	Sub-criterion final weight	rank
Social and cultural factors	0.2356	3	Social security problems	0.216	0.05088	8
			Cultural constrains	0.201	0.04735	18
			Types of relation and social norms	0.205	0.04829	17
			Poor interaction with foreign investors	0.187	0.044057	19
			Having negative feelings toward foreigners	0.191	0.04499	20
Economic factors	0.3613	2	Inflation	0.1473	0.05321	3
			Uncompetitive economy of Iran	0.1391	0.05025	13
			Bank borrowing and liquidityincrease	0.14802	0.05347	1
			Investment high risk	0.14061	0.05278	4
			Uncertainty of the exchange and fluctuation of its rate	0.1418	0.05123	7
			Constant changes and sectional decisions in the banking sector	0.14058	0.05079	9
			Lack of clear and consistent strategy in exchange and monetary policy	0.1424	0.05144	6
Political factors	0.4029	1	Lack of internal consensus on how to attract foreign investment	0.1203	0.04884	14
			Political instability	0.1252	0.05044	12
			International sanctions against Iran	0.1327	0.05346	2
			Political positioning	0.126	0.05076	10
			Respecting human rights in Iran	0.1201	0.04838	16
			Nuclear activities	0.1296	0.05221	5
			Relatively high political risk	0.1255	0.05056	11
			Security problems	0.1206	0.04858	15

This prioritization makes a comprehensive view for politicians and senior managers of ASEZ. It is worth noting that “Bank borrowing and liquidityincrease”(B3) with the weight 0.05347, “International sanctions against Iran” (C3) with the weight 0.05346 and “Inflation” (B1) with the weight 0.05321 are in the first to third rank respectively. The result is exactly consistent with the current economic conditions of the country. Almost everybody knows about the importance and effectiveness of these sub-criteria. The other sub-criteria prioritization is shown in the following figure.

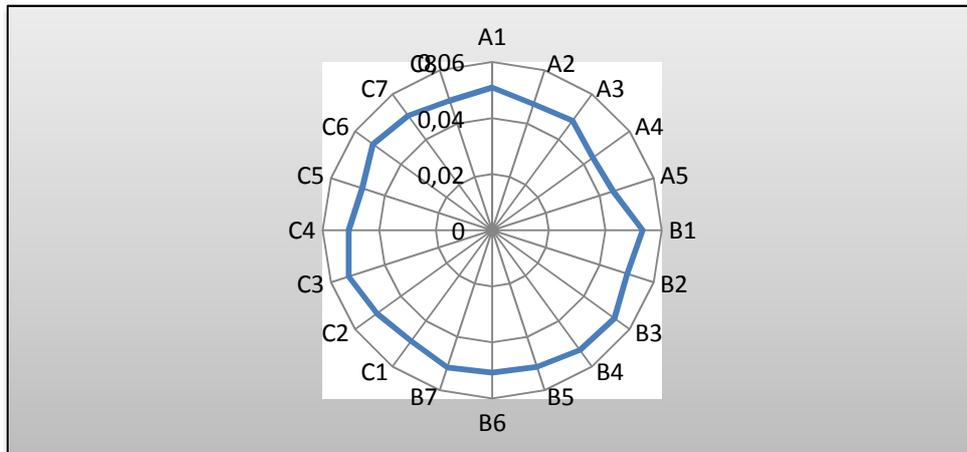


Fig 3: Final ranking of all investment-barriers sub-criteria

Weights and ranking of all major criteria and their related sub-criteria are shown in figure 4. Hence, to meet the goals and eliminate barriers a strategic direction has been provided. Therefore, if politicians are going to eliminate the barriers, they should eliminate barriers with the greatest weight at first.

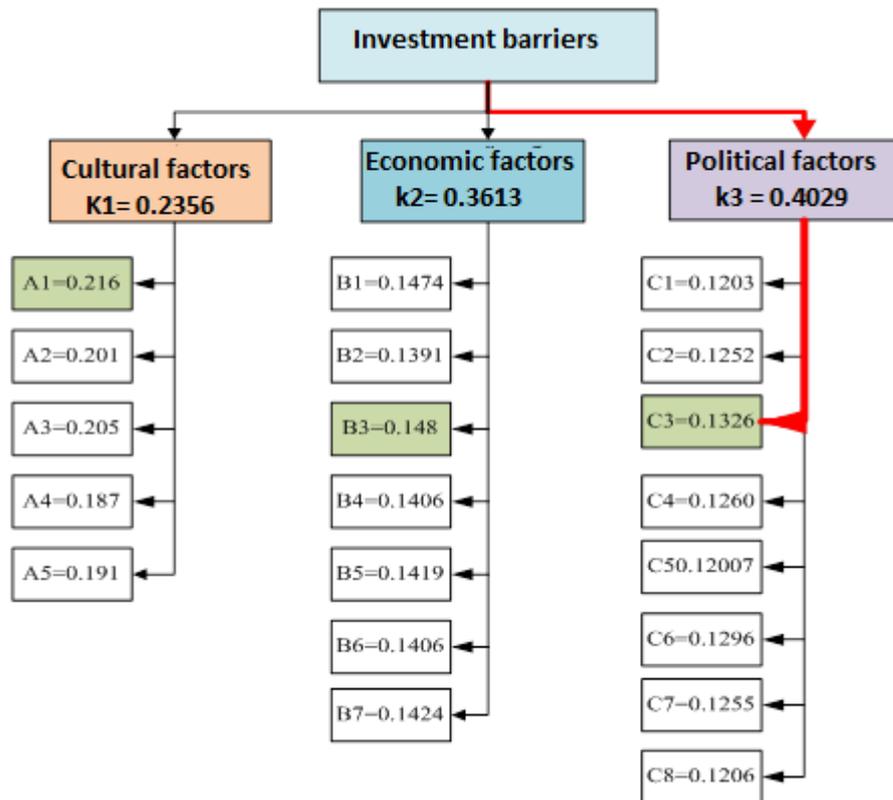


Fig 4: A strategic direction model for investment barriers

As the research results show, it is more important for foreign investors to check political risks due to globalization of economy and business. Investors try to invest confidently in other countries. Therefore, it is so important for policies, economic and political space to be reasonable. If the risk is considered too high for the investor, there would be no financial incentive toward capital attraction in that country. As a result, the role of political and economic structures of a country is effective in attracting or discouraging investment.

Iran due to the structure of its government and foreign relations with other countries is in a complex condition. Any change in domestic and foreign conditions can affect economic conditions and hence foreign investment. Political tension relations of Iran with other countries have influenced economic conditions and hence foreign investment. This is so important that any increase or decrease in the above tensions would have clear effects on foreign investment demands and activities. The results show that.

Based on the results, to eliminate the investment barriers politicians should pay special attention to major barriers in order to make the ground ready for better investment.

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