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RANKING ENTERPRENEURSHIP MAIN RISKS IN NON-PROFIT FINANCIAL FUNDS BY TODIM TECHNIQUE UNDER GREY CONDITIONS (A CASE STUDY IN IRAN)

Abstract. *Entrepreneurship risks are the most important topics that should be considered over implementation of any business. Lack of attention to entrepreneurship risk issues in new business can lead to failure in achieving expected result. According to the fact that risk issues always accompany with uncertainty and also success or failure of entrepreneurship activity seems presumable, we should provide a mechanism to consider the importance of it. The purpose of this study is to make a discussion and prioritize entrepreneurship main risks in non-profit financial funds in Iran based on uncertainty circumstance to identify main risks and then providing suitable control activity to reduce their effect. For this purpose in this paper we propose a method from combination of Todim technique and grey numbers theory to prioritize entrepreneurship risks in non-profit financial funds in Iran. The results show that incompetency of the personnel and managers, is the most important entrepreneurship risk in these funds.*

Keywords: *Entrepreneurship risks, Grey numbers, Todim technique, Non-profit financial funds.*

JEL Classification: C44-D81-E32-M13

1. Introduction

Approaches and theories which associated with social structures always consider two main factors in their evolutionary process. First discipline issues and then innovation and mutation. Innovation and continuous causes lead to evolution of arrangement and formation of a new structure indifferent levels of a social system, because innovations mainly need vital changes in attitude and behavior of persons.

Innovation is a word associated with social and economic concepts rather than technical (Drucker, 2002).

Innovation is a method or new subject defined by a person, a group or even one system. In human behavior side, the novelty of an idea is irrelevant to the first time of its usage or discovery. But, the inference and novelty of ideas are parameters that determine the response of the person or group. If idea seems new for the person or group, it is considered as an innovation (Drucker, 2002).

From early of 90 decade, we have seen evolutions in governmental part of countries, in a way that hierarchical and bureaucratic structure, the dominant form of public offices, have been changed to flexible and efficient public management. This is a comprehensive changes supported by new paradigm named entrepreneurship management (Moghimi, 2004).

At the middle of twenty century, theory of innovative entrepreneurs was established by Schumpeter (1952). This theory says that entrepreneur task is modification and evolution in manufacturing pattern through utilization of invention or in more general, it is untried technical facility in manufacturing new product, production of old product with new method, releasing new resources of material, novel market of product or organizing neoteric industry. In this definition innovation and novelty are inseparable components of entrepreneurship. In fact innovation as introduction of new things is one of the most difficult roles of entrepreneur. This task needs not only ability to create and conceptualize things but also potency of understanding whole workforces in environment. Novelty may consist of any things from new product to new distribution system or methods for developing new organization structure (Histrich et al., 2012).

Entrepreneurship is identification of opportunities, innovation in usage of opportunities and ventures some action for creating value (Yadollahi, 2005). Another definition of entrepreneurship is: process of creating new valuable things through allocation of required time and effort with consideration of financial risk, mental and social risk achieving freedom and financial and individual satisfaction (Histrich et al., 2012).

We can categorize entrepreneurs in three major groups through their purpose in entrepreneurship process: (1) Entrepreneurship for creating new business, (2) Entrepreneurship for solving social problems, and (3) Entrepreneurship for developing or improving current organization. In last type, entrepreneurship performs through formal organization structure. Goal of this kind of entrepreneurship is improvement of performance with development of organization (Yadollahi, 2005).

Any action in implementation process confront with hazards which can impediment to complete fulfillment of expected request. So the probability that causes the target turnover does not obtained named risk. This is an unfavorable situation which may expose person or organization and result into damage. This new condition can be a harmful event, preventive action or contain danger, anarchy or instability in activity path.

Starting new business always along with risks and dangers diminish chance of success. According to the report of small business administration in USA more than fifty percent of small businesses fail in first years and ninety percent of them destroy in first five years. Ames (1995) reveals these causes for failure of this kind of business: lack of experience, lack of adequate capital, lack of suitable position, lack of vigorous control, over investment in fixed assets, weak credit contract, personal use of commercial capital, and unexpected growth.

In Iran non-profit financial funds that are called 'Gharzolhasaneh funds', were established to promote benevolent activities such as allocation of facilities for marriage, employment, housing and preparation of dowry, and else, so that more founders and stockholders of these funds are private persons.

According to the fact that considering all various risks which threaten entrepreneur at initial point of new business is near impossible, our major question in this study is discovering the most critical risks at starting point of Gharzolhasaneh funds in Iran to help entrepreneur to provide suitable goals and strategies for solving and controlling these risks. Therefore, this paper survey present risks of establishing Gharzolhasaneh funds in Iran and then rank these risks through multi criteria decision making approach subject to uncertainty conditions.

There are variety techniques for solving multi criteria decision making problems. One of them is Todim technique which provided by Gomes and Lima (1992a). It is based on nonlinear prospect theory, that its value function figure is similar to gain and loss function in prospect theory. Todim technique presents a picture from difference of pair value of both alternatives (which are obtained based on each criterion) to a reference criterion. In this technique, by pair comparisons of decision making criteria and through simple technical resources, casual inconsistency in comparisons will be omitted (Gomes and Rangel, 2009).

Regarding to the current literature there are a lot of study about development of fuzzy logic in Todim technique which shows necessity of developing multi criteria decision making method in uncertainty conditions. Despite of fuzzy logic influence and expansion in decision making problem, fuzzy sets seems unable to accredit input data (Lourenzutti and Krohling, 2013). So the other intent of this paper is to provide another approach for multi criteria decision making issue under uncertainty conditions by considering the subjective and indefinite nature of decision making and entrepreneurship risks ranking process.

Grey theory is one useful approach that can effectively handle uncertain problems under small data sets (Chang et al., 2013). Hence, because decision makers use subjective judgments in decision making process and these judgments are under uncertainty conditions, thus, we propose another solution for multi criteria decision making problem by considering grey inputs in Todim technique. We use interval grey number as a score of each alternative or entrepreneurship risks.

Briefly rest of the paper composed these sections: next section submit the relevant literature review of the topic. In Section 3 a developed Todim technique proposed in form of grey numbers after a review on Todim technique and grey numbers features. In Section 4 to solve entrepreneurship risks issue in Gharzolhasaneh funds and also to illustrate proposed method of this paper we present a case study in Iran. At last conclusions are presented in Section 5.

2. Literature review

Most of the researches in this domain concentrated on effect of different variable on entrepreneurship risks or providing different prediction method for failure of businesses.

Caliendo et al. (2010) discuss about the impact of risk attitude on entrepreneurial survival. They examine the effect of positive and inverse correlation between risk attitude and decision to become self-employed on entrepreneurial survival. They believe there is a U-shaped relation between risk attitudes and entrepreneurial survival. Result of studies in German show that persons with a medium-level risk attitude survive as entrepreneur more than low or high risk attitude persons. Dvir et al. (2010) discuss about the relation between entrepreneur personalities and risk character and also connection between entrepreneur personalities and prosperity in risks. They survey 88 entrepreneurs in new ventures. Finding revealed that entrepreneur expose high level of novel and technical risk are more educated, committed, entrepreneurial, creative, risk-takers and investigative person than those in low level of technical risk. Furthermore, they find entrepreneur in high level of novel and technical risk act as personality of type A.

Caliendo et al. (2009) empirically analyzed the influence of risk taking on deciding to start new business. Findings show that less risk adverse person should be more self-employed. Sensitivity analysis shows that this is true just for people out of regular employment, while for individuals coming out of unemployment or inactivity, risk attitudes seem not to play a role in the decision process. Rosen and Willen (2002) conclude in their research that willingness to accept risk is not a dominant factor in the decision to become self-employed. Pardo (2013) examines the concurrent effect of asymmetric information and entrepreneurial risk aversion on investment decisions in private section. He used the set of Chilean and U.S. data and concluded that the risk aversion assumption has more empirical relevance in an economy where smaller privately-held businesses are relatively more prevalent than large corporate . Results of Moskowitz and Vissing-J_rgensen (2002) research revealed that independent entrepreneur tend to invest in private business which are usually small and owned by only one entrepreneur. Also they found that independent entrepreneurs who usually invest at least fifty percent of their asset in a company are more vulnerable to abrupt risks.

3. Proposed approach

Current research wants to identify and prioritize entrepreneur major risks in Gharzolhasaneh funds in Iran. There for in this study we use one of multi criteria decision making technique which named Todim based on grey numbers as input data. We introduce proposed approach in this section.

3.1. Todim technique

Todim method is one of the provided methods for solving multi criteria decision making problems (Gomes et al., 2013). We present this method as follows:

Consider decision matrix of Table 1:

Table 1. Allocated score to each alternative

Criterion	C_1	C_2	...	C_m
w_c	w_1	w_2	...	w_m
A_1	p_{11}	p_{12}	...	p_{1m}
A_2	p_{21}	p_{22}	...	p_{2m}
$\vdots$	$\vdots$	$\vdots$	$\ddots$	$\vdots$
A_n	p_{n1}	p_{n2}	...	p_{nm}

In Table 1, we have m criterion ($C_1,\ldots, C_m$) and n alternative ($A_1,\ldots, A_n$) where p_{ic} is allocated score to alternative i with respect to criterion c (for c =1,...,m). w_c (for c =1,...,m) denotes weight of the importance of criterion c. Todim method constitute following steps:

Step 1: if p_{ic} and p_{jc} are respectively allocated scores to alternative i and j with respect to criterion c, then relative difference can be calculated and according to Equation 1 related $\Phi_c(A_i, A_j)$ (for i, j =1,...,n, $i \neq j$) is calculated.

$$\Phi_c(A_i, A_j) = \begin{cases} \sqrt{w_c \times (p_{ic} - p_{jc})}, & (p_{ic} - p_{jc}) > 0 \\ 0, & (p_{ic} - p_{jc}) = 0 \\ \frac{-1}{\theta}\sqrt{\frac{-(p_{ic} - p_{jc})}{w_c}}, & (p_{ic} - p_{jc}) < 0 \end{cases} \qquad (1)$$

where θ is named reduction factor of losses

Step 2: the measurement of predomination of alternative A_i (for i =1,...,n) over alternative A_j (for j =1,...,n), that is $\delta(A_i, A_j)$, calculated through Equation 2:

$$\delta(A_i, A_j) = \sum_{c=1}^{m} \Phi_c(A_i, A_j), \forall(i, j), i \neq j \qquad (2)$$

Step 3: normalized global criterion (ξ_i) of alternative A_i(for i =1,...,n) comparing with other alternatives, is obtained from Equation 3:

$$\xi_i = \frac{\sum_{j=1}^{n} \delta(A_i, A_j) - \min \sum_{j=1}^{n} \delta(A_i, A_j)}{\max \sum_{j=1}^{n} \delta(A_i, A_j) - \min \sum_{j=1}^{n} \delta(A_i, A_j)} \qquad (3)$$

Final ranking of alternatives is based on decreasing trend of ξ_i(for i =1,...,n) in other word the best alternative has the biggest amount of ξ_i.

3.2. Grey numbers theory

Grey system theory is especially used to deal with uncertain and insufficient information (Chang et al., 2013). A grey system is a system which includes indefinite information. If the information is clear, then we show the system in white color, and if they are blurred, then we show them in black color. The related information to natural system is rather white (completely clear) nor black (completely blurred), they are combination of both of them which means grey.

We have different kinds of grey numbers, but we use interval number in this article. A grey number has vague value but we can define exact range that includes this number. Interval grey number $\otimes$ is a number within a range with lower limit x and upper limit y which can be shown as follow:

$$\otimes \in [x, y]. \quad (4)$$

Basic mathematic operators in interval grey number can be defined. Suppose that $\otimes_1 \in [a, b]$ and $\otimes_2 \in [c, d]$ are two grey numbers:

Definition 1. If $a = b$, then:

$$\otimes_1 = [a, a] = a \in R. \quad (5)$$

Definition 2. Summation operator (Daumas et al., 2009):

$$\otimes_1 + \otimes_2 \in [a + c, b + d]. \quad (6)$$

Definition 3. Symmetric of a grey number (Daumas et al., 2009):

$$-\otimes_1 \in [-b, -a]. \quad (7)$$

Definition 4. Subtraction operator (Daumas et al., 2009):

$$\otimes_1 - \otimes_2 = \otimes_1 + (-\otimes_2) \in [a - d, b - c]. \quad (8)$$

Definition 5. Multiplication operator (Daumas et al., 2009):

$$\otimes_1 \times \otimes_2 \in [\min\{ac, ad, bc, bd\}, \max\{ac, ad, bc, bd\}]. \quad (9)$$

Definition 6. Operator of multiplying scalar number K in a grey number (Li and Xu, 2007):

$$k \otimes_1 \in \begin{cases} [ka, kb], k \geq 0 \\ [kb, ka], k < 0 \end{cases} \quad (10)$$

Definition 7. Reverses of a grey number (Daumas et al., 2009):

$$\otimes_1^{-1} \in [1/b, 1/a], ab > 0 \quad (11)$$

Definition 8. Division operator (Daumas et al., 2009):

$$\otimes_1 \div \otimes_2 = \otimes_1 \times \otimes_2^{-1} \in \left[\min\left\{\frac{a}{c}, \frac{a}{d}, \frac{b}{c}, \frac{b}{d}\right\}, \max\{a/c, a/d, b/c, b/d\}\right], cd > 0, \quad (12)$$

Definition 9. Power operator (Daumas et al., 2009):

$$\otimes_1^n \in \begin{cases} [1], & n = 0 \\ [a^n, b^n], & n \text{ is odd or } a \geq 0 \\ [b^n, a^n], & n \text{ is even and } a \leq 0 \\ [0, \max\{a^n, b^n\}], & \text{otherwise.} \end{cases} \quad (13)$$

Definition 10. If *a* = *b* (Daumas et al., 2009):

$$\begin{cases} \otimes_2 < a, d < a \\ \otimes_2 > a, c > a \end{cases} \tag{14}$$

In special case if *a* = 0, then:

$$\begin{cases} \otimes_2 < 0, d < 0 \\ \otimes_2 > 0, c > 0 \end{cases} \tag{15}$$

Definition 11. $\otimes_1 < \otimes_2$, if (Jahanshahloo et al., 2009):

$$m_{\otimes_1} < m_{\otimes_2} \Rightarrow \frac{a+b}{2} < \frac{c+d}{2}, \tag{16}$$

where, $m_{\otimes_1}$ and $m_{\otimes_2}$ respectively denote center of $\otimes_1$ and $\otimes_2$.

If $m_{\otimes_1} = m_{\otimes_2}$, then it can be said:

$$w_{\otimes_1} > w_{\otimes_2} \Rightarrow \frac{b-a}{2} > \frac{d-c}{2}, \tag{17}$$

where, $w_{\otimes_1}$ and $w_{\otimes_2}$ orderly show width of grey number $\otimes_1$ and $\otimes_2$.

3.3. Proposed grey Todim method

Gomes and Lima (1992a) proposed Todim method for solving multi criteria decision making problem in their research. In a primary model of this technique, elements of decision making matrix are definite. In this section Todim technique will be developed in format of interval grey as inputs as follow:

Step (1): suppose *n* alternatives and *m* criteria that value allocated to each alternative with respect to each criterion is grey number and can be defined as interval. Consider Table 2:

Table 2. Grey decision making matrix for decision maker *k*

Criterion	C_1	C_2	...	C_m
w_c	w_1	w_2	...	w_m
A_1	$\otimes_{11k} \in [a^L_{11k}, a^R_{11k}]$	$\otimes_{12k} \in [a^L_{12k}, a^R_{12k}]$	...	$\otimes_{1nk} \in [a^L_{1mk}, a^R_{1mk}]$
A_2	$\otimes_{21k} \in [a^L_{21k}, a^R_{21k}]$	$\otimes_{22k} \in [a^L_{22k}, a^R_{22k}]$	...	$\otimes_{2nk} \in [a^L_{2mk}, a^R_{2mk}]$
⋮	⋮	⋮	⋱	⋮
A_n	$\otimes_{m1k} \in [a^L_{n1k}, a^R_{n1k}]$	$\otimes_{m2k} \in [a^L_{n2k}, a^R_{n2k}]$	...	$\otimes_{mnk} \in [a^L_{nmk}, a^R_{nmk}]$

Table 2 shows grey decision making matrix filled by *K* decision makers. In Table 2, $\otimes_{ick}$ is a grey number related to alternative *i* subject to criterion *c* provided by decision maker *k*. $w_c \in [0,1]$ is weight of criterion *c*.

In this paper we propose an approach to increase the accuracy of final solution by accessing optimum value of criteria importance weight.

Suppose *x* and *y* as minimum and maximum scores assigned to this matrix.

Step (2): consider *K* decision makers with different opinions about alternatives in a way that importance weight of each person is different. So, if $\mu_k \geq 0$ (for *k* =1,...,*K*) is weight of decision maker *k* opinions importance, then $\sum_{k=1}^{K} \mu_k = 1$.

Step (3): calculating weighted average of assigned scores:

Decision matrix of Table 2 can be shown as Table 3 based on Step (1):

Table 3. Weighted average of allocated scores to alternatives

Criterion	C_1	C_2	...	C_m
w_c	w_1	w_2	...	w_m
A_1	$\otimes_{11}\in[a_{11}^L,a_{11}^R]$	$\otimes_{12}\in[a_{12}^L,a_{12}^R]$	...	$\otimes_{1n}\in[a_{1m}^L,a_{1m}^R]$
A_2	$\otimes_{21}\in[a_{21}^L,a_{21}^R]$	$\otimes_{22}\in[a_{22}^L,a_{22}^R]$	...	$\otimes_{2n}\in[a_{2m}^L,a_{2m}^R]$
$\vdots$	$\vdots$	$\vdots$	$\ddots$	$\vdots$
A_n	$\otimes_{m1}\in[a_{n1}^L,a_{n1}^R]$	$\otimes_{m2}\in[a_{n2}^L,a_{n2}^R]$	...	$\otimes_{mn}\in[a_{nm}^L,a_{nm}^R]$

According to Table 3:

$a_{ic}=\sum_{k=1}^{K}\mu_k a_{ick}$, for all *i*s and *c*s. (18)

a_{ic} is weighted average of allocated score to alternative *i* subject to criterion *c* by considering weight of opinion importance of all decision makers.

Step (4): calculating optimum importance weight of criteria

We can consider function of criteria importance weight for each alternative as follow (Xu, 2007):

$Z_i(\mathrm{w})=\sum_{c=1}^{m}w_c a_{ic}$, for all *i*s (for *i* =1,...,*n*). (19)

If $Z_i^-=x$ and $Z_i^+=y$ (for *i* =1,...,*n*), then we can integrate achievement level of all alternative by max-min operator provided by Zimmermann and Zysno (1980). We optimize Program 20 to obtain optimum value of criteria importance weight, as follow:

$$\max\ \sum_{i=1}^{n}\lambda_i,$$
s.t: (20)
$$\frac{\mathrm{Z_i(w)-Z_i^-}}{\mathrm{Z_i^+-Z_i^-}}\geq\lambda_i/\lambda_i\ \geq\alpha/\sum_{c=1}^{m}w_c=1/w_c\geq 0,\ \text{for } i=1,\dots,n,\ c=1,\dots,m.$$

where, $\alpha\in[0,1]$ is α-cut level and λ_i (for *i* =1,…,*n*) is achievement level of alternative *i*. w_c^* (for *c* =1,...,*m*) is optimum value of importance weight of criterion *c* according to result of Program 20.

Step (5): normalization of grey numbers:

First we calculate the column summation of interval in Table 2 by Definition 2:

$(\otimes_{1c}+\otimes_{2c}+\cdots+\otimes_{mc})\in\left[\sum_{i=1}^{m}a_{ic}^L,\sum_{i=1}^{m}a_{ic}^R\right]$, for $c=1,\dots,m$. (21)

If $(\sum_{i=1}^{n}a_{ic}^L)(\sum_{i=1}^{n}a_{ic}^R)>0$, then we can determine normalized grey number of *ic* th ($\acute{\otimes}_{ic}$) as follow:

$$\acute{\otimes}_{ic}\in[p_{ic}^L,p_{ic}^R]=[a_{ic}^L,a_{ic}^R]/[\textstyle\sum_{i=1}^{n}a_{ic}^L,\sum_{i=1}^{n}a_{ic}^R],\ \text{for } c=1,\dots,m, \quad (22)$$
$$=[a_{ic}^L,a_{ic}^R]\times[1/\textstyle\sum_{i=1}^{n}a_{ic}^R,1/\sum_{i=1}^{n}a_{ic}^L].$$

Normalized matrix of grey numbers in Table 3 is depicted in Table 4:

Table 4. Grey normalized matrix

Criterion	C_1	C_2	...	C_m
w_c	w_1	w_2	...	w_m
A_1	$\acute{\otimes}_{11}\in[p_{11}^L,p_{11}^R]$	$\acute{\otimes}_{12}\in[p_{12}^L,p_{12}^R]$	...	$\acute{\otimes}_{1m}\in[p_{1m}^L,p_{1m}^R]$
A_2	$\acute{\otimes}_{21}\in[p_{21}^L,p_{21}^R]$	$\acute{\otimes}_{22}\in[p_{22}^L,p_{22}^R]$	...	$\acute{\otimes}_{2m}\in[p_{2m}^L,p_{2m}^R]$
$\vdots$	$\vdots$	$\vdots$	$\ddots$	$\vdots$
A_n	$\acute{\otimes}_{n1}\in[p_{n1}^L,p_{n1}^R]$	$\acute{\otimes}_{n2}\in[p_{n2}^L,p_{n2}^R]$	...	$\acute{\otimes}_{nm}\in[p_{nm}^L,p_{nm}^R]$

Step (6): calculating paired comparisons of alternatives:

According to normalized numbers in Table 2, paired comparison of each alternative through each criterion is as follow:

A. If result of paired comparison of grey number $\acute{\otimes}_{ic} \in [p_{ic}^L, p_{ic}^R]$ toward number $\acute{\otimes}_{jc} \in [p_{jc}^L, p_{jc}^R]$ is $\acute{\otimes}_{ic} - \acute{\otimes}_{jc} \in [p_{ic}^L - p_{jc}^R, p_{ic}^R - p_{jc}^L]$ as Definition 4 and it is $\acute{\otimes}_{ic} - \acute{\otimes}_{jc} > 0$ as Equation 15 in Definition 10, then:

$$\left[\Phi_c(A_i, A_j)^L, \Phi_c(A_i, A_j)^R\right] = \sqrt{w_c \times (\acute{\otimes}_{ic} - \acute{\otimes}_{jc})} = \sqrt{[w_c(p_{ic}^L - p_{jc}^R), w_c(p_{ic}^R - p_{jc}^L)]} \quad (23)$$

where, $w_c \in [0,1]$ is importance weight of criterion c. Based on Definition 9, Equation 23 can be written as:

$$\left[\Phi_c(A_i, A_j)^L, \Phi_c(A_i, A_j)^R\right] = \left[\left(w_c(p_{ic}^L - p_{jc}^R)\right)^{1/2}, \left(w_c(p_{ic}^R - p_{jc}^L)\right)^{1/2}\right]. \quad (24)$$

B. If result of paired comparison of grey number $\acute{\otimes}_{ic} \in [p_{ic}^L, p_{ic}^R]$ toward number $\acute{\otimes}_{jc} \in [p_{jc}^L, p_{jc}^R]$ is $\acute{\otimes}_{ic} - \acute{\otimes}_{jc} \in [p_{ic}^L - p_{jc}^R, p_{ic}^R - p_{jc}^L]$ as Definition 4 and it is $\acute{\otimes}_{ic} - \acute{\otimes}_{jc} < 0$ as Equation 15 in Definition 10, then:

$$\left[\Phi_c(A_i, A_j)^L, \Phi_c(A_i, A_j)^R\right] = \frac{-1}{\theta}\sqrt{\frac{-(\acute{\otimes}_{ic} - \acute{\otimes}_{jc})}{w_c}}$$
$$= \frac{-1}{\theta}\sqrt{[(p_{jc}^L - p_{ic}^R)/w_c, (p_{jc}^R - p_{ic}^L)/w_c]}. \quad (25)$$

Equation 25 in Definition 9 converted to Equation 26:

$$\left[\Phi_c(A_i, A_j)^L, \Phi_c(A_i, A_j)^R\right] = \frac{-1}{\theta}\left[\left((p_{jc}^L - p_{ic}^R)/w_c\right)^{1/2}, \left((p_{jc}^R - p_{ic}^L)/w_c\right)^{1/2}\right]$$
$$= \left[\frac{-\left((p_{jc}^R - p_{ic}^L)/w_c\right)^{1/2}}{\theta}, \frac{-\left((p_{jc}^L - p_{ic}^R)/w_c\right)^{1/2}}{\theta}\right]. \quad (26)$$

C. If result of paired comparison of grey number $\acute{\otimes}_{ic} \in [p_{ic}^L, p_{ic}^R]$ toward number $\acute{\otimes}_{jc} \in [p_{jc}^L, p_{jc}^R]$ is $\acute{\otimes}_{ic} - \acute{\otimes}_{jc} \in [p_{ic}^L - p_{jc}^R, p_{ic}^R - p_{jc}^L]$ as Definition 4 and equal to zero, then:

$$\left[\Phi_c(A_i, A_j)^L, \Phi_c(A_i, A_j)^R\right] = [0,0] = 0. \quad (27)$$

D. If result of paired comparison of grey number $\acute{\otimes}_{ic} \in [p_{ic}^L, p_{ic}^R]$ toward number $\acute{\otimes}_{jc} \in [p_{jc}^L, p_{jc}^R]$ is $\acute{\otimes}_{ic} - \acute{\otimes}_{jc} \in [p_{ic}^L - p_{jc}^R, p_{ic}^R - p_{jc}^L]$ as Definition 4 and contain negative zero and positive number, then if ε is very little and $\varepsilon \geq 0$, grey number $\acute{\otimes}_{ic} - \acute{\otimes}_{jc}$ can be written as combination of these three parts:

$$\acute{\otimes}_{ic} - \acute{\otimes}_{jc} \in [p_{ic}^L - p_{jc}^R, p_{ic}^R - p_{jc}^L] = [p_{ic}^L - p_{jc}^R, -\varepsilon] + [0,0] + [\varepsilon, p_{ic}^R - p_{jc}^L]. \quad (28)$$

Because $[p_{ic}^L - p_{jc}^R, -\varepsilon] < 0, [0,0] = 0$ and $[\varepsilon, p_{ic}^R - p_{jc}^L] > 0$, according to Equations 24, 26 and 27, grey number $\acute{\otimes}_{ic} - \acute{\otimes}_{jc}$ is:

$$\left[\Phi_c(A_i, A_j)^L, \Phi_c(A_i, A_j)^R\right] = \frac{-1}{\theta}\sqrt{-[(p_{ic}^L - p_{jc}^R)/w_c, -\varepsilon/w_c]} + 0 + \sqrt{[w_c\varepsilon, w_c(p_{ic}^R - p_{jc}^L)]}$$
$$= \left[\frac{-\left((p_{jc}^R - p_{ic}^L)/w_c\right)^{1/2}}{\theta}, \frac{-(\varepsilon/w_c)^{1/2}}{\theta}\right] + \left[(w_c\varepsilon)^{1/2}, \left(w_c(p_{ic}^R - p_{jc}^L)\right)^{1/2}\right]$$

$$= \left[\left((w_c\varepsilon)^{1/2} - \frac{((p_{jc}^R - p_{ic}^L)/w_c)^{1/2}}{\theta}\right), \left((w_c(p_{ic}^R - p_{jc}^L))^{1/2} - \frac{(\varepsilon/w_c)^{1/2}}{\theta}\right)\right]$$
$$= \left[\left(\frac{\theta(w_c\varepsilon)^{1/2} - ((p_{jc}^R - p_{ic}^L)/w_c)^{1/2}}{\theta}\right), \left(\frac{\theta(w_c(p_{ic}^R - p_{jc}^L))^{1/2} - (\varepsilon/w_c)^{1/2}}{\theta}\right)\right]. \quad (29)$$

Step (7): calculating summation of $\left[\delta(A_i, A_j)^L, \delta(A_i, A_j)^R\right]$ for each comparison of A_i, A_j:

According to Definition 2, summation of grey numbers $\left[\Phi_c(A_i, A_j)^L, \Phi_c(A_i, A_j)^R\right]$ for each comparison A_i, A_j can be written as Equation 30 and shown by $\left[\delta(A_i, A_j)^L, \delta(A_i, A_j)^R\right]$:

$$\left[\delta(A_i, A_j)^L, \delta(A_i, A_j)^R\right] = \sum_{c=1}^{m}\left[\Phi_c(A_i, A_j)^L, \Phi_c(A_i, A_j)^R\right], \forall(i,j)$$
$$= \left[\sum_{c=1}^{m}\Phi_c(A_i, A_j)^L, \sum_{c=1}^{m}\Phi_c(A_i, A_j)^R\right], \forall(i,j). \quad (30)$$

Step (8): calculating global index:

Global index of grey numbers for each alternative can be calculated as follow:

$$\left[\xi_i{}^L, \xi_i{}^R\right] = \frac{\sum_{j=1}^{n}\left[\delta(A_i,A_j)^L, \delta(A_i,A_j)^R\right] - \delta_{\min}}{\delta_{\max} - \delta_{\min}} = \frac{\left[\sum_{j=1}^{n}\delta(A_i,A_j)^L, \sum_{j=1}^{n}\delta(A_i,A_j)^R\right] - [\delta_{\min}, \delta_{\min}]}{\delta_{\max} - \delta_{\min}}$$
$$= \frac{\left[\sum_{j=1}^{n}\delta(A_i,A_j)^L - \delta_{\min}, \sum_{j=1}^{n}\delta(A_i,A_j)^R - \delta_{\min}\right]}{\delta_{\max} - \delta_{\min}} = \left[\left(\frac{\sum_{j=1}^{n}\delta(A_i,A_j)^L - \delta_{\min}}{\delta_{\max} - \delta_{\min}}\right), \left(\frac{\sum_{j=1}^{n}\delta(A_i,A_j)^R - \delta_{\min}}{\delta_{\max} - \delta_{\min}}\right)\right], \quad (31)$$

where,

$$\delta_{\min} = \min\left\{\sum_{j=1}^{n}\delta(A_1, A_j)^L, \sum_{j=1}^{n}\delta(A_2, A_j)^L, \dots, \sum_{j=1}^{n}\delta(A_n, A_j)^L\right\}$$
$$= \min_i \sum_{j=1}^{n}\delta(A_i, A_j)^L, \quad (32)$$
$$\delta_{\max} = \max\left\{\sum_{j=1}^{n}\delta(A_1, A_j)^R, \sum_{j=1}^{n}\delta(A_2, A_j)^R, \dots, \sum_{j=1}^{n}\delta(A_n, A_j)^R\right\}$$
$$= \max_i \sum_{j=1}^{n}\delta(A_i, A_j)^R. \quad (33)$$

Step (9): ranking alternatives:

In this paper, we use Definition 11 to rank the interval grey numbers $\left[\xi_i{}^L, \xi_i{}^R\right]$. By paired comparisons of interval grey numbers, all alternatives of decision making problem can be ranked.

In next section we use proposed method to solve entrepreneurship main risks prioritization problem of Gharzolhasaneh funds in Iran.

4. Case study

There are a lot of Gharzolhasaneh funds in Iran which serve customers. The aim of these funds is to promote benevolent activities such as facilities for marriage, employment, housing and preparation of dowry which is comply with more profit for founders and stockholders of these funds through receiving fees of granted facilities. The main purposes of these funds are: Revival and expansion of tradition culture of charity affairs in society (C1), Satisfying basic needs of the deprived people by paying free interest loans (C2), Employment and elimination of unemployment crisis (C3), Establishment and resumption of small workshops and corporations (C4), Encouragement and motivation of benevolent people (C5), Profitability and generation of wealth (C6), Creating trust between depositors and obtaining social respect and position (C7), and Specializing the operation of free interest loans (C8).

Like all businesses, establishment of Gharzolhasaneh funds is accompanied by risks and dangers, the identification and prioritization of them is essential for good decision making. According to existing literature and also decision makers' attitude in Gharzolhasaneh funds scope, the most important risks in constitution of these funds are as follow:

- Increasing the postponed demands of fund (A1):

If the funds can not receive more than one fifth of their dues, they will face the risk of bankruptcy. When the claims of these funds follow the progress way, this means that economy moves toward higher recession. Inflationary economy is the reason of postponing demands of banks and Gharzolhasaneh funds. Now, economy of Iran faces a recession intensified by inflation. When economy feces recession, demands of creditors especially producers can not be paid and this leads to payment inability. It should be noted that one of the reasons of bankruptcy of global banks in the recent economic crisis is lack of receiving overdue claims.

- Credit risk (A2):

Credit risk is one of the crucial factors in bankruptcy of funds which lead to liquidity risk and inconsistency of input and output flows. Volatilities of macroeconomic variables, lack of integration in policy making and prudential regulations of super- visionary organizations, inconsistency of activities volume and existing frame-work, lack of utilization of information technology and integrated information systems among interested associations, lack of an efficient and valid rating procedures, lack of internal controls based on information technology are some of impressive factors in debt enhancement. Payment of free interest loans without valid securities or by external pressures leads to rise of fund's claims.

- Gap between resources and uses (A3):

Due to the fact that resources refer to the money entering a fund while uses refer to the moneys paid as loan. Therefore, payment of loans to obtain higher profit without considering fund resources and inability in attraction of resources from society leads to receive loans with higher rate of interest than granted facilities interest by founder from central bank which generate losses for such funds. This subject is more critical when the capital of a fund with resources is less than the uses and.

- Inefficiency of managers and employees (A4):

Lack of understanding of organizational mission and objectives by managers and employees, and also, improper transmission of it in the whole organization can be one of the entrepreneurial risks of Gharzolhasaneh funds.

- Defects of laws and regulations (A5):

Lack of efficient laws and paradoxes in existing laws are the barriers in the way of succession of Gharzolhasaneh funds.

- Lack of legal deposit in the central bank and lack of support from the central bank in the crisis time (A6).
- Lack of fair balance between resources and uses (A7):

Assigning facilities more than existing assets leads to inability in providing financial support of depositors and bankruptcy of such funds.

- Rumors of bankruptcy (A8):

Lack of on time liquidity and response to clients sometimes result in rumors of bankruptcy by some competitors or individuals. This rumor makes people rush to the fund to take out their deposit and also these funds have no support from the central bank, so they can not response to the massive number of public demands and thus face bankruptcy.

The aim of this section is to prioritize and rate entrepreneurship risks of Gharzolhasaneh funds. Therefore, based on the proposed method, the following steps are taken:

4.1. Determining alternatives

In this step, all aforementioned risks of entrepreneurship in the Gharzolhasaneh funds domain are considered as existing options.

4.2. Defining criteria

In this step, all objectives of establishing Gharzolhasaneh funds introduced in this section are considered as criteria of prioritizing risks of Gharzolhasaneh funds.

In this study, we use the opinions of 10 decision makers in Gharzolhasaneh funds domain with equal weight of preference ($\mu_k = 0.1, \text{for } k = 1, \ldots, 10$). Decision makers selected the scores of each alternative based on a five-point scale, so that according to Figure 1 linguistic variables of this scale were defined as very strong, strong, medium, weak and very weak.

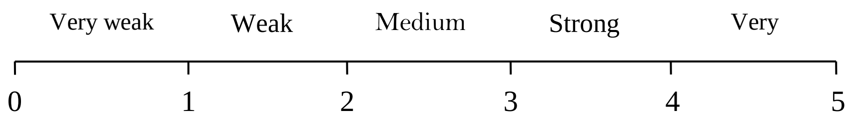

Figure 1. Linguistic variables in a five-point scale

For example, grey number associated with linguistic variable 'strong' is equal to [3, 4] in Figure 1.

4.3. Executive steps of prioritization based on the proposed method

Steps of solving this problem based on the proposed method are:

Step 1: In the decision matrix of Table 5, according to weight of decision makers' opinions importance, weighted average of scores related to linguistic variables, which allocated to each alternative based on criteria are provided:

Table 5. Weighted average of scores allocated by decision makers

		Criteria															
		C1		C2		C3		C4		C5		C6		C7		C8	
		Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound
Alternatives	A1	0.9	1.9	2.9	3.9	2.1	3.1	1.9	2.9	3.1	4.1	3.5	4.5	2.9	3.9	2.2	3.2
	A2	1.8	2.8	2.8	3.8	2.4	3.4	1.9	2.9	3.3	4.3	3.6	4.6	3.1	4.1	2.2	3.2
	A3	2.1	3.1	3.2	4.2	3.1	4.1	2.9	3.9	0.9	1.9	3.8	4.8	2.2	3.2	2.9	3.9
	A4	3.9	4.9	3.7	4.7	3.1	4.1	1.9	2.9	3.7	4.7	3.3	4.3	3.8	4.8	1.9	2.9
	A5	3.1	4.1	0.6	1.6	1.9	2.9	0.5	1.5	2.7	3.7	2.1	3.1	3.8	4.8	3.8	4.8
	A6	3.2	4.2	0.9	1.9	2.1	3.1	1.1	2.1	0.2	1.2	0.2	1.2	3.1	4.1	1.1	2.1
	A7	1.9	2.9	3.1	4.1	2.8	3.8	3.1	4.1	0.7	1.7	2.1	3.1	2.1	3.1	0.8	1.8
	A8	3.1	4.1	1.8	2.8	1.9	2.9	1.9	2.9	3.7	4.7	2.9	3.9	3.9	4.9	0.6	1.6

Step 2: To define the weight of criteria importance and to use Program 20, centers of grey numbers of Table 5 are provided in Table 6:

Table 6. Centers of grey numbers in Table 5

Criteria		C1	C2	C3	C4	C5	C6	C7	C8
Importance weight		w1	w2	w3	w4	w5	w6	w7	w8
Alternatives	A1	1.4	3.4	2.6	2.4	3.6	4	3.4	2.7
	A2	2.3	3.3	2.9	2.4	3.8	4.1	3.6	2.7
	A3	2.6	3.7	3.6	3.4	1.4	4.3	2.7	3.4
	A4	4.4	4.2	3.6	2.4	4.2	3.8	4.3	2.4
	A5	3.6	1.1	2.4	1	3.2	2.6	4.3	4.3
	A6	3.7	1.4	2.6	1.6	0.7	0.7	3.6	1.6
	A7	2.4	3.6	3.3	3.6	1.2	2.6	2.6	1.3
	A8	3.6	2.3	2.4	2.4	4.2	3.4	4.4	1.1

Considering Table 6, a function of criteria importance weight can be determined for each alternative as follow:

$Z_1(w) = 1.4w_1 + 3.4w_2 + 2.6w_3 + 2.4w_4 + 3.6w_5 + 4w_6 + 3.4w_7 + 2.7w_8$
$Z_2(w) = 2.3w_1 + 3.3w_2 + 2.9w_3 + 2.4w_4 + 3.8w_5 + 4.1w_6 + 3.6w_7 + 2.7w_8$
$Z_3(w) = 2.6w_1 + 3.7w_2 + 3.6w_3 + 3.4w_4 + 1.4w_5 + 4.3w_6 + 2.7w_7 + 3.4w_8$
$Z_4(w) = 4.4w_1 + 4.2w_2 + 3.6w_3 + 2.4w_4 + 4.2w_5 + 3.8w_6 + 4.3w_7 + 2.4w_8$
$Z_5(w) = 3.6w_1 + 1.1w_2 + 2.4w_3 + w_4 + 3.2w_5 + 2.6w_6 + 4.3w_7 + 4.3w_8$
$Z_6(w) = 3.7w_1 + 1.4w_2 + 2.6w_3 + 1.6w_4 + 0.7w_5 + 0.7w_6 + 3.6w_7 + 1.6w_8$
$Z_7(w) = 2.4w_1 + 3.6w_2 + 3.3w_3 + 3.6w_4 + 1.2w_5 + 2.6w_6 + 2.6w_7 + 1.3w_8$
$Z_8(w) = 3.6w_1 + 2.3w_2 + 2.4w_3 + 2.4w_4 + 4.2w_5 + 3.4w_6 + 4.4w_7 + 1.1w_8$

where, $Z_i^- = 0$ and $Z_i^+ = 5$ (for i = 1,…, 8).

Based on Program 20, optimum value of importance weight of each criterion can be defined as Program 34.

$$\max \ \sum_{i=1}^{8} \lambda_i,$$

s.t:

$$\frac{(1.4w_1 + 3.4w_2 + 2.6w_3 + 2.4w_4 + 3.6w_5 + 4w_6 + 3.4w_7 + 2.7w_8) - 0}{5 - 0} \geq \lambda_1,$$

$$\frac{(2.3w_1 + 3.3w_2 + 2.9w_3 + 2.4w_4 + 3.8w_5 + 4.1w_6 + 3.6w_7 + 2.7w_8) - 0}{5 - 0} \geq \lambda_2,$$
$$\frac{(2.6w_1 + 3.7w_2 + 3.6w_3 + 3.4w_4 + 1.4w_5 + 4.3w_6 + 2.7w_7 + 3.4w_8) - 0}{5 - 0} \geq \lambda_3,$$
$$\frac{(4.4w_1 + 4.2w_2 + 3.6w_3 + 2.4w_4 + 4.2w_5 + 3.8w_6 + 4.3w_7 + 2.4w_8) - 0}{5 - 0} \geq \lambda_4, \quad (34)$$
$$\frac{(3.6w_1 + 1.1w_2 + 2.4w_3 + w_4 + 3.2w_5 + 2.6w_6 + 4.3w_7 + 4.3w_8) - 0}{5 - 0} \geq \lambda_5,$$
$$\frac{(3.7w_1 + 1.4w_2 + 2.6w_3 + 1.6w_4 + 0.7w_5 + 0.7w_6 + 3.6w_7 + 1.6w_8) - 0}{5 - 0} \geq \lambda_6,$$
$$\frac{(2.4w_1 + 3.6w_2 + 3.3w_3 + 3.6w_4 + 1.2w_5 + 2.6w_6 + 2.6w_7 + 1.3w_8) - 0}{5 - 0} \geq \lambda_7,$$
$$\frac{(3.6w_1 + 2.3w_2 + 2.4w_3 + 2.4w_4 + 4.2w_5 + 3.4w_6 + 4.4w_7 + 1.1w_8) - 0}{5 - 0} \geq \lambda_8,$$
$\lambda_i \geq 0.5$, (for $i = 1, \ldots, n$)
$\sum_{c=1}^{8} w_c = 1$,
$0.05 \leq w_c \leq 0.2$, (for $c = 1, \ldots, 8$)
$w_c \geq 0$, (for $c = 1, \ldots, 8$).

where, in Program 34, the interval approach is used to define the limits of w_c (for c = 1,…, 8) with minimum value 0.05 and maximum 0.2. Alpha-cut level is considered as 0.5. Program 34 is solved by Lingo software and optimal importance weight for each criterion is 0.2, 0.15, 0.2, 0.05, 0.05, 0.05, 0.2 and 0.1, respectively.

Step 3: Normalization of Table 5 data. Table 7 provides normalized matrix of Table 5.

Table 7. Normalized grey numbers of Table 5

		Criteria															
		C1		C2		C3		C4		C5		C6		C7		C8	
		Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound
Alternatives	A1	0.032	0.095	0.107	0.195	0.077	0.16	0.082	0.191	0.118	0.224	0.119	0.209	0.088	0.157	0.094	0.206
	A2	0.064	0.14	0.104	0.19	0.088	0.175	0.082	0.191	0.125	0.235	0.122	0.214	0.094	0.165	0.094	0.206
	A3	0.075	0.155	0.119	0.21	0.113	0.211	0.125	0.257	0.034	0.104	0.129	0.223	0.067	0.129	0.123	0.252
	A4	0.139	0.245	0.137	0.235	0.113	0.211	0.082	0.191	0.141	0.257	0.112	0.2	0.116	0.193	0.081	0.187
	A5	0.111	0.205	0.022	0.08	0.069	0.149	0.022	0.099	0.103	0.202	0.071	0.144	0.116	0.193	0.162	0.31
	A6	0.114	0.21	0.033	0.095	0.077	0.16	0.047	0.138	0.008	0.066	0.007	0.056	0.094	0.165	0.047	0.135
	A7	0.068	0.145	0.115	0.205	0.102	0.196	0.134	0.27	0.027	0.093	0.071	0.144	0.064	0.124	0.034	0.116
	A8	0.111	0.205	0.067	0.14	0.069	0.149	0.082	0.191	0.141	0.257	0.098	0.181	0.119	0.197	0.026	0.103

Step 4: To calculate the values of $\overline{\Phi}_c(A_i, A_j)$, first we determine relative difference of each alternative compared to other alternatives through data of Table 7. Due to limited space in the present paper, only the calculations of alternative A1 are provided. Table 8 shows the matrix of results of paired comparisons of all alternatives to alternative A1.

Table 8. Paired comparisons matrix of alternatives compared with alternative A1

	C1		C2		C3		C4		C5		C6		C7		C8	
	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound
A1-A2	-0.108	0.031	-0.083	0.091	-0.099	0.072	-0.109	0.109	-0.117	0.099	-0.095	0.087	-0.077	0.062	-0.113	0.113
A1-A3	-0.123	0.02	-0.103	0.076	-0.135	0.047	-0.175	0.066	0.014	0.19	-0.105	0.08	-0.04	0.09	-0.158	0.083
A1-A4	-0.213	-0.044	-0.128	0.058	-0.135	0.047	-0.109	0.109	-0.139	0.083	-0.081	0.097	-0.105	0.041	-0.093	0.126
A1-A5	-0.173	-0.016	0.027	0.173	-0.073	0.09	-0.017	0.169	-0.084	0.121	-0.026	0.138	-0.105	0.041	-0.216	0.045
A1-A6	-0.178	-0.019	0.012	0.162	-0.083	0.083	-0.056	0.143	0.052	0.216	0.063	0.203	-0.077	0.062	-0.042	0.16
A1-A7	-0.113	0.027	-0.098	0.08	-0.119	0.058	-0.188	0.057	0.025	0.197	-0.026	0.138	-0.036	0.093	-0.023	0.172
A1-A8	-0.173	-0.016	-0.033	0.128	-0.073	0.09	-0.109	0.109	-0.139	0.083	-0.063	0.111	-0.109	0.038	-0.01	0.181

Supposing $\theta = 1$, if $\varepsilon = 0.001$, then results of Table 8 can be rewritten as Table 9 based on Equation 29.

Table 9. Rewriting the results of Table 8

	C1		C2		C3		C4		C5		C6		C7		C8	
	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound
A2	-0.72	0.008	-0.73	0.035	-0.688	0.049	-1.469	-0.068	-1.523	-0.071	-1.374	-0.075	-0.604	0.041	-1.052	0.006
A3	-0.77	-0.007	-0.815	0.025	-0.807	0.026	-1.862	-0.084	0.027	0.097	-1.439	-0.078	-0.435	0.063	-1.247	-0.009
A4	-1.032	-0.471	-0.91	0.012	-0.807	0.026	-1.469	-0.068	-1.66	-0.077	-1.269	-0.072	-0.709	0.02	-0.957	0.012
A5	-0.93	-0.28	0.064	0.161	-0.589	0.064	-0.572	-0.049	-1.292	-0.064	-0.708	-0.058	-0.709	0.02	-1.46	-0.033
A6	-0.943	-0.311	0.043	0.156	-0.631	0.058	-1.054	-0.057	0.051	0.104	0.056	0.101	-0.604	0.041	-0.637	0.026
A7	-0.737	0.003	-0.794	0.028	-0.758	0.037	-1.931	-0.088	0.035	0.099	-0.708	-0.058	-0.412	0.066	-0.464	0.031
A8	-0.93	-0.28	-0.454	0.057	-0.589	0.064	-1.469	-0.068	-1.66	-0.077	-1.113	-0.067	-0.723	0.017	-0.3	0.035

where for alternative A1, we have:

$\sum_{j=2,\ldots,8}\left[\delta(A_1,A_j)^L,\delta(A_1,A_j)^R\right] = [-47.24,-0.98]$.

Step 5: Similar to Step 4, we can calculate index $\sum_j\left[\delta(A_i,A_j)^L,\delta(A_i,A_j)^R\right], i \neq j$, for other alternatives, which can be shown in Table 10.

Table 10. Results of $\sum_j\left[\delta(A_i,A_j)^L,\delta(A_i,A_j)^R\right]$ for all alternatives

Alternatives	A1		A2		A3		A4		A5		A6		A7		A8	
Intervals	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound
$\sum_j\left[\delta(A_i,A_j)^L,\delta(A_i,A_j)^R\right]$ (for $i \neq j$)	−47.24	−0.98	−45.28	0.65	−45.07	−1.79	−40.01	1.86	−50.47	−3.2	−65.3	−13.93	−48.94	−2.83	−48.11	−0.62

Step 6: Based on Equations 32 and 33, we have, $\delta_{\min} = -65.3$ and $\delta_{\max} = 1.86$.

Based on Equation 31, global index for each alternative is calculated and the results are shown in Table 11.

Table 11. Results of $\left[\xi_i^L,\xi_i^R\right]$ for all alternatives

Alternatives	A1		A2		A3		A4		A5		A6		A7		A8	
Intervals	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound	Low Bound	Up Bound
$[\xi_i^L, \xi_i^R]$	0.27	0.96	0.3	0.98	0.3	0.95	0.38	1	0.22	0.92	0	0.76	0.24	0.93	0.26	0.96

Step 7: Regarding the results of Table 11 which are grey numbers, final ranking of alternatives through suggested method is initially provided based on reduction of m_i (for i =1,…,8) values (centers of grey numbers). If the values of at least two m_i (for i =1,…,8) are equal, we use w_i (for i =1,…,8) (width of grey numbers) for final ranking of alternatives. In this regard, with respect to unequal obtained values of m_i (for i =1,…,8), final ranking of problem performed by comparison of m_i (for i =1,…,8) values in Table 12.

Table 12. Final ranking of alternatives

A_i	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8
$[\xi_i^L, \xi_i^R]$	[0.27,0.96]	[0.3,0.98]	[0.3,0.95]	[0.38,1]	[0.22,0.92]	[0,0.76]	[0.24,0.93]	[0.26,0.96]
m_i	0.613	0.64	0.623	0.688	0.573	0.382	0.587	0.609
w_i	0.344	0.342	0.322	0.312	0.352	0.382	0.343	0.354
Rank	4	2	3	1	7	8	6	5

Based on obtained results, inefficiency of managers and employees is the most important factor in failure of Gharzolhasaneh funds in Iran and credit risks are in the second rank.

5. Conclusion

In the process of executing any new business, after identification of most significant entrepreneurship risks and their prioritization, control actions for reducing effects and enhancing accessibility of expected results should be done. In this paper, prioritization of entrepreneurship risks of Gharzolhasaneh funds under uncertainty environment had been investigated. So, after investigation and exchanging views with decision makers of Gharzolhasaneh funds and determining the most important entrepreneurship risks in this domain, a combination method of Todim technique and grey theory was proposed and used for prioritization of risks. Results showed that inefficiency of managers and employees is regarded as the most significant entrepreneurship risks in these funds, understanding the objectives and missions of organization by managers and employees and proper transmission of it in the whole organization and also utilization of capable and qualified employees are the solutions which had been suggested to reduce disruptive consequences of these risks.

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