JEAS
Journal of Economics and Administrative Sciences
E-ISSN: 2148-1792 P- ISSN: 1302-2024
Volume 3, Supplement Issue 3
www.jeasweb.org

Identifying and ranking components affecting valuation of startups with FAHP model approach

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ABSTRACT
Nowadays, valuation of startups is one of the most serious challenges not only for the stock market but also for the capital market. The present study was an attempt to identify the components affecting the valuation of startups and then confirm the opinion of startup experts. In this applied research, by reviewing previous studies, 42 indicators and components affecting the valuation of startups were identified and using the CVR relationship, eight components were confirmed by experts. In the second stage, a 12-member group consisting of startup experts of Science and Technology Park of Azad University first confirmed the results of the CVR method using the Delphi method and then ranked these components using the fuzzy hierarchical process analysis method. The results showed that "innovation" was the most important component for valuation of startups, followed by "talented and specialized team", "market traction and size", "product initial sample", "appropriate idea", "intellectual property", "individuals' credibility" and "patent", respectively. Finally, recommendations were presented for valuation of startups.
Keywords: Valuation, Startup, Fuzzy Hierarchical Process Analysis

Introduction

Defining the value of a business idea is not only one of the most important steps in creating a new investment, but also the most complex part. To access an external source of financing, it is not enough to have a great business idea or high entrepreneurial attitudes, but it is necessary to evaluate the financial stability of the business model and its future profitability. For business investors, the value of the time of imitating a share is determined by stock they receive over the life of the investment (Miloud et al., 2012). Valuation is generally divided into two classes of pre-money valuation and post-money valuation (Hitchner, 2017). Valuation is very important, since if the investor knows how much he wants to invest, he will find the percentage of ownership of the company that he will receive after the investment. Valuation aligns with the ambitions of the entrepreneur and his investor, so he needs a structure that helps and guarantees a fair way (De Clercq et al., 2006). However, how the value of a startup can be calculated? Valuation of a company is a process that aims to find an estimate of real value through one or more specific methods. In fact, we need to discover some computational elements and criteria for evaluating new business, policy and investment strategy. Valuation of startups is more complex and difficult than

evaluating mature companies. In fact, startups have low levels of revenue, negative cash flows in the early stages, and limited information about future economic and financial performance. Startups typically operate in innovative sectors that are in the early stages of their life cycle and make it difficult to find comparable companies (Cambria, 2017). One of the major challenges of the startup ecosystem is financing, so that this issue can be considered the vital element of these companies. Domestic investors do not pay much attention to startups due to the inherent risk and overvaluations by their shareholders and the high amounts of capital required.The new rules, including sentences of the Sixth Development Plan have created new restrictions on the financing of this sector, so there is no clear vision for their financing within the country. Also, foreign investors are not very willing to invest due to sanctions and the future of JointComprehensive Plan ofAction and devaluation of the national currency and the risk of non-liquidity of investments and even capital transfers, so financing will be one of the main challenges of the startup ecosystem in coming years. Startups can be considered a box that its value can be added by assigning items such as patents, management groups, and so on. Making this special box can be very expensive, you should look for people who can help you in financing and these people are called investors. The logic of your deal with your investors is that, for example, "Give me one dollar and I will return the amount to you with an x% increase in capital"; but how much should X be? It depends on the amount of investment and it is quite difficult to determine the amount of investment before valuing a work (Nasser, 2016). Valuation of startups is one of the serious challenges not for the stock market but for the capital market. However, how capital market managers cope with this great challenge is a point that will illuminate its future. In this research, we seek to answer this challenge at the theoretical and research level to first identify the components affecting the valuation of startups and then to confirm the opinion of experts and economic consultants in this field. Since this research seeks to identify and rank the components affecting the valuation of startups using a fuzzy hierarchical process analysis approach, the objectives of the research include the following cases:

1-Identifying the components affecting the valuation of startups

2-Ranking the components affecting the valuation of startups using fuzzy hierarchical analysis

2-Theoretical principles and literature of study

A startup is a human institution established to create a new product, service or value (Salamzadeh & Kesim, 2015). Van de Ven et al (1984) were among the first researchers considered three main approaches to studying startup creation. They considered entrepreneurial, organizational, and ecological approaches and argued that previous studies had examined only one of these three approaches without considering the others. As they point out, "the organizational approach discusses the conditions under which an organization is planned, as well as the processes followed in its initial development stage, which have important outcomes for its structure and function in the next life."

A startup is a human enterprise designed to create new products and services in conditions of extreme uncertainty (Rice, 2011). In fact, a startup is a term used to describe the production of a business products or services, to solve problems, or to provide services to current claims while the solution is unknown and success is not guaranteed. According to the Oxford Dictionary, a startup is a newly-established business. Many entrepreneurs tend to select more by their definition, for example, Gopalakrishnan (2016) calls any business that is less than 4 years old with less than 50 employees and a $ 10 million revenue ceiling a startup. Grant et al (2019) have a similar idea to this concept, although not as precise as the previous definition. Inostopedia describes a startup as a young company that is still developing or just starting to develop and small size of company, small number of people and bringing innovation to the markets are the characteristics of this type of business. Blank & Dorf (2012) also emphasis that start-ups tend to look for unknown business models, while large companies are already known. It should be noted that startups are not smaller versions of large companies. Although there is no clear definition for startup companies, various criteria such as number of employees, annual sales, or net profit are some of the dimensions that can help differentiate between the large and small companies. There are often two types of startup companies. The first type of startup is described in the "entrepreneur" scenario, where one thinks he has the reasons and actions to turn ideas into business opportunities and create value. This phenomenon refers to the pre-birth stage or the beginning of the company's life cycle. In short, this type is created just before

the foundation of the company, where the owner (entrepreneur) intends to turn an idea into a profitable opportunity by planning for a startup company. The second type describes start-ups that are currently operating, but they have not yet reached the status of a small developed and operational company. These startups are usually at the birth stage or the beginning of the company's life cycle (Leach &Melicher, 2012). Aurelian (2008) defines the first type of startups as companies in which the concept of the initial business is formed and the initial products and services that will be provided are considered. The founder (entrepreneur) and some key personnel are the main employees and the financial needs are low because the main financial resources include the owner's capital, family, friends and co-workers. The risk of delivery failure is very high. However, the definition of the second type of startup companies is explained by Dilger (2012), using different criteria. Other definitions can be discussed here. According to Beck et al (2008), a company with 5 to 50 employees is defined as a startup. Hence, there are different definitions of startups. However, this study is an attempt for valuing each type of startup and identifying the factors in this valuation at different stages of the startup growth cycle. De Oliveira and Zotes (2018) examined valuation methods for startups. The purpose of the mentioned study was to review and analyze the various methods used for the evaluation process and identify the most suitable ones for startups in the Brazilian market. Sassi (2016) introduced an improved valuation method for startups active in the social media industry. Theoretical and academic valuation methods of companies fail to provide appropriate value for startups in the initial stage. Thus, this article aims at creating an improved model for entrepreneurs, so that they can understand the value of their idea and the risky nature of their business. Based on existing articles and primary and secondary studies, this paper provides an integrated model of evaluation for startup companies in the early stages. This model is enriched by the practical needs explicitly requested from the valuation model. Also, this research paper provides important guidelines for interpreting and understanding the numbers derived from the model. Also, Miloud et al (2012) state that when valuation is not possible based on outputs (future cash flows) - as it is true for new companies due to their infancy and lack of revenue - they can be valued based on inputs (such as entrepreneur, industry attractiveness, etc.). As a result, the value of a company is affected by many quantitative and non-quantitative (qualitative) factors. Korityak and Fichtel (2012) identified the factors involved in the growth of startups and the factors influencing financial decisions. This paper focuses on identifying the factors influencing financial decisions, especially growth-oriented decisions. A sample of 8 businesses was studied in a qualitative research to achieve the research goal. Their funding selections have been analyzed using financial and psychological theories. The study also examined the startup interaction with a business plan and investors. The results showed that growth-oriented investors use domestic funds in the first stage and the lack of financial capital indicates the main reason behind this decision. Also, it is clear that bank loans are an appropriate alternative for startups that mainly need collateral.

Jonsson& Samuelsson (2008) conducted a study entitled "Business valuation: Valuation IT Companies in the Jönköping Area". The mentioned study was conducted on Jönköping IT companies to describe how to use valuation techniques in a way that is used before making a profit. Intangible assets have high importance to the industry. Thus, the main aim was to determine how they would be valued. To achieve the goal, a qualitative research was conducted. Initial data were collected via telephone interviews and six face-to-face interviews. The results showed that the current net value approach is used more when valuing the information technology of companies and intangible assets in which goodwill is significant due to synergies. The relative valuation approach is also useful, especially for companies that are in the early stages of the lifecycle, because they show no historical facts. In a study entitled “Valuation of startups: A real authority approach", Bank &Wibmer examined the problems of common methods for valuation of startups. They did not consider it appropriate to use discounted cash flow-based methods for valuation of startups and provided a model with a future deferred claims approach in an arbitrage-free set. They showed how adding options (growth options) affects the value of a startup even when it generates negative cash flows when investing. Emphasizing the dimensions and characteristics of the business itself, Mason and Stark (2004) identified the importance of financial figures and other traceable factors such as sales, evidence of market size and position, and the degree of support of patent as factors influencing valuation. DehghaniEshratabad and Al-Badawi (2016) conducted a study entitled "Valuation

of startups by venture capitalists using the real authority approach in the first round of financing". Based on the simulation results, the percentage of ownership of the entrepreneur and venture capitalist was determined. In addition, by comparing the results of the proposed approach with the results of the current net value method, it was concluded that traditional methods do not have the necessary validity for valuation of such startups. In the final section, recommendations are presented for development of the model under competitive conditions or its development for other stages of investment. Chitsazan et al (2015) identified and leveled the factors affecting the valuation of startups by venture capitalists. The results of the interviews led to the extraction of twelve factors. In the next step, using interpretive structural modeling technique, the mentioned factors were classified and the way of effect of each of these factors on each other was determined. Accordingly, the results showed that the two factors of "scientific and professional records" and "work records" were at the highest level (fourth level). In other words, they had the highest level of influence. Also, the factor of "bargaining power" was at the lowest level, that is, it had the highest level of dependence.Ten other factors were placed between these levels. Tabatabaeian and Gharibi (2014) identified and ranked the technology valuation indicators in the automotive industry. The results showed that the indicators related to the benefit dimension and dimension of the terms included in the contract had the highest importance in estimating the value of technology. Finally, a real sample was evaluated using the identified coefficients. Technology valuators and developers of technology exchange contracts in general, and automotive industry officials in particular, can benefit from the results of this study. Kazemi and JahangiriLivari (2013) compared the efficiency of free cash flow models in valuing companies. The present study compares free cash flow models in valuation of companies. The results show that the Olson modified model has more explanatory power than other models and the free cash flows calculated based on the " Lehn and Poulsen ", "Verdi" and " Kapeland " models have the highest efficiency in the Olson modified model, respectively, to determine the value of the company shares.

Methodology

This research is practical in terms of type and since its results can be useful for investors and startups, it can be important for the country's officials in the field of economics and valuation of startups. The research method descriptive-survey in terms of way of obtaining information. The statistical population of this research is experts and specialists of startups located in the Science and Technology Park of Azad University. In this research, library and survey methods were used to collect the required information. In addition to the library study, the questionnaire was used as a tool for data collection. Using a case study of startups located in the Science and Technology Park of Azad University, three questionnaires of the present study were the content validity questionnaire of the indicators, the Delphi method of selecting effective indicators and the pairwise comparison questionnaire. The respondents of the three questionnaires of this research included experts and specialists of startups located in the Science and Technology Park of Azad University.

This research has been surveyed in three steps in the survey stage. In the first stage, a group of experts consisted of 10 people, including experts and specialists of startups located in the Science and Technology Park of Azad University. Using the opinion of this 10-member expert group who were purposefully and judiciously selected, using CVR content analysis, 8 indicators out of 42 indicators extracted from library studies were selected as components affecting the valuation of startups.

To confirm the content analysis method in the first stage, Delphi questionnaires was used. In other words, in the second stage, a 42-item questionnaire was completed by a group of 12 experts from 79 startups active in the Azad University Science and Technology Park. The results of the CVR questionnaire obtained with an expert group of 10 people were confirmed in the second round of Delphi. Then, to determine the importance and prioritization of these components, pairwise questionnaires was completed by a 12-member expert group from 79 startups active in the Science and Technology Park of Azad University, selected using purposeful and judgmental method. The selection criteria included having at least a master's degree, at least 5 years of employment history and experience of valuation of startups.

- **Questionnaire to confirm the content validity of the components**

Quantifying the opinions of the members of the expert group by calculating the CVR: The opinions of the panel members assigned to the (essential) option are quantified by the content validity ratio (CVR) (Lawshe, 1975). The following formula is used for this purpose:

Equation 1: $CVR: \frac{n_e - \frac{n}{2}}{\frac{n}{2}}$

ne: The number of expert members who have identified that dimension or question necessary.

n: is the total number of members of the expert group.

Table 1 shows the interpretation of the accepted CVR value corresponding to the components of the experts. Thus, based on the number of experts who evaluated the questions, the minimum acceptable CVR value should be based on the table below. Questions that their CVR is less than the desired value according to the number of experts evaluating the question should be excluded from the test because they do not have acceptable content validity based on the content validity index.

Table 1: Acceptable CVR value - Lawshe relation

Minimum acceptable CVR value based on the number of scoring experts					
number of experts	CVR value	number of experts	CVR value	number of experts	CVR value
5	0.99	11	0.59	25	0.37
6	0.99	12	0.56	30	0.33
7	0.99	13	0.54	35	0.31
8	0.75	14	0.51	40	0.29
9	0.78	15	0.49		
10	0.62	20	0.42		

- **Delphi questionnaire**

In this study, to determine the degree of consensus among group members, Kendall coordination coefficient, which is represented by W, was used. This coefficient was used to measure the consensus of individuals among several rank classes related to N objects or individuals. In fact, by using this scale, we can find a rank correlation between K rank sets. Such a scale is especially useful in studies of validity among judges or reaching a favorable consensus to complete Delphi rounds. Kendall coefficient of coefficient shows that people who have sorted several categories based on their importance have used essentially the same criteria to judge the importance of each category, and in this respect agree with each other. The Kendall coefficient is calculated based on the following formula:

$$w = \frac{\sum \left(R_j - \frac{\sum R_j}{N}\right)^2}{\frac{1}{12}K^2(N^3 - N)}$$

R_j = sum of ranks related to one factor

K = number of rank sets

N = number of ranked factors

$\frac{1}{12}K^2(N^3 - N)$ = maximum squared sum of deviations from mean R_js

- **Pairwise questionnaire for comparison of components**

The fuzzy hierarchical process analysis method is one of the multi-criteria decision making methods. The algorithm of this method is the same as the hierarchical process analysis method. Also, to analyze this method, a fuzzy hierarchical process analysis questionnaire must be designed. The criteria are

compared in pairs. Fuzzy spectra should also be used for analysis. To collect the experts' views and opinions in the fuzzy hierarchical analysis process method, the expert questionnaire should be designed according to the following steps:

1-The first step in this stage is to form a hierarchical model of research, that is, a model in which the factors and indicators of the problem are well defined. To form a questionnaire, the exact number of factors must be given. If we want to increase or decrease the factor, the questionnaire must be created again.

2-In the second step, the pairwise comparisons of the criteria should be formed, that is, the criteria should be compared in pairs. This comparison is based on fuzzy spectra.

Determining the validity of the questionnaire

The multi-criteria decision-making method questionnaire does not have validity and reliability, but there is a rate called incompatibility rate, which some call equivalent to reliability. This rate is calculated in the fuzzy AHP questionnaire using the Gogus and Boucher method (Zhu, 2014). Chang fuzzy AHP method generally uses Gogus and Boucher compatibility rates.

Gogus and Boucher compatibility rate: In 1998, Gogus and Boutcher proposed that two matrices (middle number and fuzzy number bound) can be derived from each fuzzy matrix to examine compatibility, and then the compatibility of each matrix can calculated using the Saati method.

The steps for calculating the Gogus and Boucher compatibility rates of fuzzy matrix comparisons are as follows:

Step 1: In the first step, divide the fuzzy triangular matrix into two matrices. The first matrix consists of the middle numbers of triangular judgments and the second matrix consists of the geometric mean of the upper and lower bounds triangular numbers.

Step 2: Calculate the weight vector of each matrix using the Saati method in the following order.

To calculate the compatibility rate (CR), divide the Compatibility Index (CI) by the value of the Random Index (RI). If the resulting value is less than 0.1, the matrix is considered compatible and usable. To obtain the values of the random indexes (RI), Saati formed 100 matrices with random numbers and calculated the values of incompatibility and their mean. However, since the numerical values of fuzzy comparisons are not always integers, and even the geometric mean generally converts them to non-integer numbers, even if the (1 to 9) Saati scale is used, RI table of Saati cannot be used. Thus, Gogus and Boucher re-generated the Random Index (RI) table for fuzzy pairwise comparison matrices by generating 400 random matrices (Kahraman et al., 2003).

If both of these calculated indices were less than 0.1, the fuzzy matrix is compatible. If both were greater than 0.1, the decision maker is asked to reconsider the priorities given.

An important point in the research process is that the variables used in this research are expressed subjectively, qualitatively and verbally, and it seems difficult to measure them by definite methods with mathematical numbers. Researchers will solve this problem using the AHP technique in a fuzzy environment. In this study, Chang development method has been used to determine the importance and prioritization of components affecting the valuation of startups. To implement this method, the opinions of different experts must first be combined using the geometric mean method, but since an incompatible matrix can lead to false results, it is essential to examine the compatibility of the expert aggregation matrix before solving the problem. In this research, it was done using the Gogus and Boucher method (1998). After distributing the first stage questionnaire using Lawshe rule (1975) and applying the Delphi method in the second stage, with the opinion of the expert group, out of 42 components extracted, 8 indicators were identified as components affecting the valuation of startups.

Table 2: Gogus and Boutcher (1988) Random Indices

RI_g	RI_m	n
0	0	1
0	0	2
0.1796	0.489	3
0.2627	0.7937	4
0.3597	1.072	5
0.3818	1.1996	6
0.409	1.2874	7
0.4164	1.341	8
0.4348	1.3793	9
0.4455	1.4095	10
0.4536	1.4181	11
0.4776	1.4462	12
0.4691	1.4555	13
0.4804	1.4913	14
0.488	1.4986	15

- **Fuzzy hierarchical process analysis method**

The Analytic Hierarchy Process (AHP) is one of the most popular multi-criteria decision techniques developed by Thomas L. Saati in the 1970s. This method can be useful when the decision-making process is faced with multiple options and decision indicators. Indicators can be quantitative or qualitative. The basis of the AHP method is based on pairwise comparisons. In this method, the decision maker begins his work by providing a decision hierarchy tree. This tree shows the criteria and decision options. Then, a series of pairwise comparisons is performed. These comparisons determine the weight of each factor in terms of competing options. Finally, AHP logic combines matrices obtained from pairwise comparisons to achieve the optimal decision (Azar, Faraji, 2016).

AHP method can only provide good results in certain conditions and with accurate information, but sometimes accurate information is not available. Before weighing and ranking methods, an explanation of the used fuzzy numbers should be provided. In this study, verbal expressions instead of definite numbers were used to determine the weight of the indicators as well as the ranking of the options.

Steps of fuzzy hierarchical analysis method (Chang method)

Fuzzy hierarchical analysis has two known methods, which are Chang method and Yager method. Chang method is the most well-known and common method in Iran. In this section, we describe its steps and use it in this research.

The steps of fuzzy AHP by Chang method are as follows (Chang, 1996):

Step 1: Drawing a hierarchical diagram

In any multi-criteria analysis, drawing a hierarchical diagram (decision tree) is one of the first and of course important steps, because after drawing this diagram, we will know the purpose, the hierarchical structure of the indicators and sub-indicators, and the options. In principle, even before designing a fuzzy hierarchical process analysis questionnaire, the decision hierarchy plan must be drawn. It should be noted that the fuzzy hierarchical method questionnaire is highly similar to the ordinary hierarchical method questionnaire. The format is appropriate, which reduces the error of respondents (experts), otherwise, if you work with inappropriate questionnaire formats, you will have a problem called high incompatibility rate.

Step 2: Defining fuzzy numbers for pairwise comparisons

At this stage, it is necessary to define your fuzzy numbers that are needed to perform even pairwise comparisons so that experts can provide their answers accordingly.

Step 3: Forming a pairwise comparison matrix using fuzzy numbers

At this stage, the questionnaires are provided to the experts and they answer them. Therefore, the researcher now has a matrix of pairwise comparisons containing fuzzy numbers.

What should we do when we are faced with multiple respondents? The surest work is to search the answer in the original source of this method, that is, in the main article of the Chang method (1996). Chang's fuzzy AHP article states that when faced with multiple answers (which is true in 99% of cases), we take the arithmetic mean or geometric mean of the opinions in only one half of the matrix (Chang, 1996).

If there are experts to make a decision and the fuzzy number is $\tilde{a}_{ijk} = \left(\tilde{l}_{ijk}, \tilde{m}_{ijk}, \tilde{u}_{ijk}\right)$, the following equations are used for averaging:

It means that lower bound of fuzzy numbers is minimized and middle numbers of fuzzy numbers are averaged and upper bound of the numbers is maximized (Chen et al, 2018).

$$l_{ijk} = min\left(\tilde{l}_{ijk}\right) \quad k = 1, 2, \dots, K$$

$$m_{ijk} = \sqrt[k]{\prod_{k=1}^{K} \tilde{m}_{ijk}}$$

$$u_{ijk} = Max\left(\tilde{u}_{ijk}\right) \quad k = 1, 2, \dots, K$$

Step 4: Calculating the S matrix for each row of the pairwise comparison matrix

Ss are triangular fuzzy numbers that are calculated using the following equation:

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

In the above equation, M is a triangular fuzzy number inside the matrix of pairwise comparisons. In fact, when calculating the matrix S, we add each of the components of the fuzzy number to the equation and multiply the sum by the fuzzy inverse. This step is similar to calculating normalized weights in the conventional AHP method, but with fuzzy numbers.

Step 5: Calculating the degree of magnitude of S relative to each other

In this step, Sis are compared to each other in terms of magnitude, based on the following formula:

$$V(M_2 \geq M_1) = hgt(M_1 \cap M_2) = \mu_{M_2}(d) = \begin{cases} 1 & \text{if } m_2 \geq m_1 \\ 0 & \text{if } l_1 \geq u_2 \\ \dfrac{l_1 - u_2}{(m_2 - m_1) - (m_1 - l_1)} & \text{otherwise} \end{cases}$$

Where,

$M_2 = (l_2, m_2, u_2)$ and $M_1 = (l_1, m_1, u_1)$ are two triangular fuzzy numbers.

Step 6: Calculating the weight of the criteria and options in the pairwise comparison matrices

In this step, it is sufficient to obtain the non-normalized weight vector by calculating the minimum V values calculated in the previous step.

Step 7: Calculating the final weight vector

Finally, we normalize the weight vector obtained from the previous step, which was not normalized, to obtain the final weight vector, which is our ultimate goal in fuzzy calculations.

Note: After collecting the matrices of pairwise comparisons of the components from the experts, their opinions are combined through a geometric mean, but since an incompatible matrix can lead to false results, the compatibility is examined before the other steps. This is done using the method provided by Gogus and Boucher. Also, in cases where the numerical incompatibility rate is more than 0.1, the expert is asked to reconsider his pairwise comparisons.

After forming all matrices of pairwise comparisons between components for each of the matrices, the compatibility rate (CR) must be calculated using the following formula.

$$CR = \frac{CI}{RI}$$

The Compatibility Index (CI) shows the degree of deviation from compatibility, which is obtained as follows:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

In the above formula, n is the size of the matrix of pairwise comparisons and RI is a random compatibility index, or the index of randomly generated weights, which can be extracted from the corresponding table of Gogus and Boucher (1998). If the obtained (CR) is less than 0.1, the comparisons made are acceptable; otherwise the comparisons should be done again with more information and accuracy and by more experienced people.

Analysis of research data

- **CVR method**

In this section, several factors that affect the valuation of startups were identified according to valid articles and sources. To more accurately identify these factors, a questionnaire based on content validity (CVR) was prepared and presented to experts. Finally, the opinion of experts on the effect or non-effect of the components on the valuation of startups was determined that the final information and statistics are given in Table 3:

Table 3: Factors affecting the valuation of startups based on CVR

row	characteristic	component	Measured CVR value (minimum optimal CVR value = 0.62)
1	C1	appropriate idea	1
2	C2	Product initial sample	1
3	C3	Patent	1
4	C4	Intellectual Property	1
5	C5	Innovation	1
6	C6	Market traction and size	1
7	C7	Credibility of individuals	0.8
8	C8	Having a talented and specialized team	1

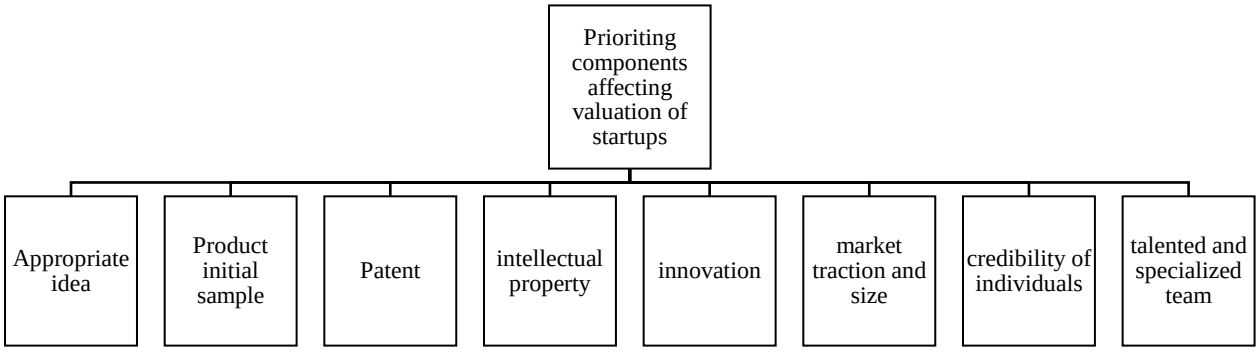
- **Delphi method**

In this section, to confirm the results of the CVR method, a questionnaire based on the Delphi method was designed again and this time it was sent to a group of 12 experts to compare with the results of the CVR method and select the most important components for ranking. For this purpose, a 42-component questionnaire was sent to the experts and they were asked to evaluate them according to the importance of each component. Since the aim was to confirm the results of the CVR and the range used in the CVR was three values in the Delphi method, three-value Likert scale was used. In the first questionnaire, the value of Kendall coefficient was equal to 0.409. For this purpose, the second round questionnaire was sent along with the mean values of each component obtained from the first round questionnaire. The value of Kendall coefficient was obtained 0.433 in this stage. Since Kendall coefficient has changed only with the value of 0.02 in these two stages, based on Habibi et al. (2014), it can be stopped. Since the scale was three-value scale, the median is 2, so any component that a mean of more than 2 is reported to experts for ranking with FAHP. The components above 2 are listed in Table 4.

Table 4: Mean of each component

components	Minimum optimal mean value = 2
	measured mean value
appropriate idea	2.67
Product initial sample	2.67
Patent	2.58
Intellectual Property	2.58
Innovation	2.67
Market traction and size	2.75
Credibility of individuals	2.75
Having a talented and specialized team	2.67

- **Prioritizing the components affecting the valuation of startups by FAHP method**



✓**Drawing a hierarchical diagram**

In this research, the fuzzy hierarchical diagram is two-level and we have no option. Therefore, at the highest level of the goal and in Diagram 1, in the next level, components are placed and the goal is to prioritize them.

✓**Assessing the compatibility of experts' pairwise comparison matrices**

In this section, first the raw questionnaire received from the experts is presented and then the pairwise comparison matrix with the application of fuzzy numbers is given. As mentioned, the experts used verbal

and linguistic variables and codes 1 to 5 and for inverse effect, -2 to -5 was used. First, a pairwise comparison matrix with these codes was provided and then by applying fuzzy numbers, experts' pairwise comparison matrix with fuzzy numbers was prepared.

✓**The final weight and ranking of the components affecting the valuation of startups**

In the last stage of the fuzzy hierarchical process, we rank the components affecting the valuation of startups according to the weight obtained in the previous stage. As shown in Table 4, "Innovation" is ranked first in terms of prioritizing the components that affect the valuation of startups, followed by talented and specialized team", "market traction and size", "product initial sample", "appropriate idea", "intellectual property", "credibility of individuals" and "patent", respectively.

Table 5: Final weight and ranking of components affecting the valuation of startups

name	weight	rank
appropriate idea	0.124	5
Product initial sample	0.126	4
Patent	0.121	8
Intellectual Property	0.123	6
Innovation	0.129	1
Market traction and size	0.127	3
Credibility of individuals	0.122	7
talented and specialized team	0.128	2

Discussion and Conclusion

The aim of this study is to identify the components affecting valuation. In this study, after reviewing the research studies, a list of factors affecting the valuation of startups was prepared and provided to supervisors and advisors for confirming. After confirming by professors and applying the necessary corrections on the proposed criteria, the experts were selected and Lawshe CVR method was implemented. After analyzing the content of the components before sending them to experts for prioritization, the Delphi questionnaire was distributed and collected, which confirmed the CVR results in two stages. In the third stage, to prioritize and rank the components affecting the valuation of startups, the FAHP pairwise comparison questionnaire was designed and provided to the group of experts. The results showed that "innovation" is the most important component in valuation of startups, followed by talented and specialized team", "market traction and size", "product initial sample", "appropriate idea", "intellectual property", "credibility of individuals" and "patent", respectively. Attracting a venture capitalist is an important point for entrepreneurs. Most entrepreneurs are excited by the first offer from an investor and are looking to sign the contract. But the point is that there are doubts that ultimately overwhelm the entrepreneurs. This is a major challenge for many startup founders. Lack of cash is a challenge that startups face. Therefore, they demand help from foreign investors for financing and are very willing to take cash to cover their expenses, and in many cases, following such financial decisions is the main reason for the failure of startups. Therefore, based on the research results, some recommendations on valuation of the startups were presented as follows:

- Valuation is not only science but requires its own art: Evaluating companies is usually based on their potential for future profitability. Since there is no clear picture of the future, the valuation of companies is best estimated with the least error. For a stable company with a significant market share, this estimate can be made with a certain degree of accuracy, but valuation of startups with innovative products or services is very difficult, since many customers do not know such startups well. For this reason, it is difficult to increase and attract customers. Valuation of such companies requires taking into account the uncertainty in estimating their future.

- To achieve the correct estimation of certain principles according to the priority results of the components affecting the valuation, it is recommended:

Innovation: it means turning an invention into a marketable product or process. In other words, innovation is the successful exploitation of new ideas. It is recommended to pay attention to this index for valuation because the most important reason for the success or failure of a project depends on the project innovations.

Having a talented and specialized team: Investors invest in a team first. They need to be convinced that research and development team members, especially those responsible for development, are talented and able to achieve the necessary technical goals. However, it should be noted that the above-mentioned cases are only indicators and cannot be considered conclusive evidence. A deeper analysis of these parameters will give a better estimate. There are also other parameters such as the reputation of the founders or all those who support the company and its stock value. As you can see, these are more qualitative elements and are often difficult to number them. This point highlights the creative aspect of valuation of startups.

Market traction and size: Providing a picture of the market traction for your product and the prices you set is the most important thing that attracts the investor. If the investor knows the number of users or consumers of your products, he will be willing to invest.

Product initial sample: Having an initial sample that represents your product or service is one of the positive factors that determine the value of your startup. Having a minimum acceptable product is also effective. Therefore, considering the importance of this index for designing and making an initial sample, it is recommended that you seek help from experienced and specialized companies in designing an initial sample.

Idea: This factor represents the core value of a startup. Therefore, investors are encouraged to value technological and innovative ideas and startup experts and managers are encouraged to use methods such as brainstorming, gamestorming, SCAMPER technique, mind mapping, and six thinking hats to create new ideas.

Intellectual property: legal rights resulting from mental and intellectual activity in the fields of industry, science, literature and art, which must be seen and valued by the investor.

Credibility of individuals: There are people who can attract capital only through their credibility. Therefore, it is suggested to increase credibility and resume in your startup with well-known and reputable people by creating a communication channel, or earn credibility by registering a patent, working in a reputable company, international scientific research articles, etc.

Patent: A patent is an exclusive right granted to an inventor or his legal representative in return for a patent. Therefore, since e-businesses and similar electronic and smart products introduce themselves as new startups every day, it is recommended to differentiate your patent from a huge flood of these startups to gain more points by investors in the final valuation.

Evaluating startups is always a challenge due to their dynamic nature. It is important to use creative thinking to create a valuable and logical way to value startups. Professional consultants can probably be helpful in valuation of these startups. Regarding these consultants, at least the following two approaches should be considered. Financial experts are usually conservative in their estimates. Unlike financial experts, legal experts are aggressive in their estimates. Both of these perspectives can help you in valuation of your startup.

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