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Identifying and assessing the risk of Internet startup companies using the Interpretive Structural Modelling (ISM) technique

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Abstract

Risk means the acceptance of an unfortunate event and its effects. In other words, the effect of uncertainty on goals is called risk. This effect can be positive, negative or both. Uncertainty means that the occurrence of an effect or its consequence is unknown, the occurrence is unknown and its consequence is certain, the occurrence is certain and its consequence is unknown. Risk is an inherent part of all projects and its management improves performance in project management and the results of that project. Project risks are derived from aspects of scope, time and cost or affecting them; Therefore, their analysis and prioritization can play a significant role in the sustainable success of the project. New companies are facing dynamic and less experienced risks. For this purpose, in this research, the challenges and risks of Internet startups have been identified by experts in the form of 9 risks, and the interpretive structural modeling technique has been used to analyze and determine the levels of risks. . Based on the calculated prioritization, "theft of users' information within the network" is at the lowest level of risk and "not applying the right policy to collect fees from users of products" is obtained at the highest level of the risk model of new Internet companies. Also, relationships and mutual effects between risks have been identified using this technique.

Keywords Risk management, ISM, internet start-up business, risk identification.

Introduction

Startup founders, due to the lack of sufficient and correct information, high uncertainty and the need to make quick decisions, have largely resorted to their own initiative and preconceptions, and this brings with it many biases. These biases and reliance on intuition often help us as cognitive tools to make quick decisions in conditions of high uncertainty and complexity, but in some cases they are also wrong and sophistical (Khashei and Asadi, 2018).

Many projects fail to achieve the expected goals, i.e. benefits, cost, scope and time. The presence of risk and uncertainty in the project causes a decrease in the accuracy of the appropriate estimation of the goals and can reduce the efficiency of the projects. Therefore, the need to recognize and manage risk in the project is quite clear (Hosseinzadeh and Khaljani, 2012).

The purpose of project risk management is to identify and analyze risk in such a way that it becomes easy to understand and manage risk more effectively (Mojtahedi at el, 2010).

A systematic risk management process has three main steps as follows (Duijne et al, 2008):

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1- Risk identification and classification;
2- risk analysis;
3- Risk adjustment.
Since one of the problems of project managers is identifying and how to deal with risk in the project, identifying and prioritizing risk is an important issue in risk management, because if the risks are not paid attention to, it can cause delay or increase the cost of the project.
A large amount of research has been done on the startup industry. However, few studies have been conducted in the field of threatening risks of service providers on the internet, so this research aims to compensate this research gap by identifying risks and prioritizing them to an acceptable level.
For this purpose, in this research, the theoretical foundations and background of the research related to the identification and risk assessment of Internet startup companies have been discussed. Then, using the Interpretive Structural Modelling (ISM) technique, risks have been identified, analyzed and prioritized. This technique is a method to create and understand the relationships between the elements of a complex system. In other words, interpretive-structural modeling is an interactive process in which a set of different and related elements are structured in a comprehensive systematic model. Structural-interpretive modeling helps in identifying the internal relationships of variables and is a suitable technique for prioritizing and analyzing the effect of one variable on other variables. It can also prioritize and determine the level of the elements of a system, which provides great help to managers for better implementation of the designed model.

2- Theoretical foundations and research background

A startup is a business that is formed based on the ideas of an entrepreneur or an individual founder, and this company is looking for a repeatable and scalable business model. To be more precise, startups are a business model in which development is an integral part of them, and these businesses seek to meet customer needs and solve problems (Robehmed, 2013). Startups are new businesses that tend to get rid of individuality, hire many employees, and demand expansion and scalability (Riita Katila at el, 2014). Startups face high environmental uncertainty and also experience a high failure rate, but the minority who overcome these barriers will have a high talent and capacity for growth and impact (Erin Griffith, 2014). Private startups that are valued above one billion dollars are called unicorns, the largest number of unicorns are based in China, and the second rank belongs to Americans. The most famous unicorn startups include Uber, Xiaomi and Air B&B.

Many researches have been done about the importance of startup as well as the emergence, emergence and effectiveness of internet service provider companies.
For example, Gui Sai Wong et al. (2017) in an article titled “Continuity and Reliability of Using Mobile Taxi Booking Program Services” considered perceived usefulness, attitude and satisfaction as important indicators in the willingness to continue using a mobile taxi booking program (MTB). In another research, García al-Medía and his colleagues (2017) in their article entitled “The impact of knowledge-based factors on competition, analysis on guidance” consider the startup industry suitable for strategic goals and objectives, Because this industry is an industry with entrepreneurs and small and medium business companies.
Khashai and Esadi (2018) designed a model for strategic control in Internet startups and tested it using interpretive structural modeling and expert opinion.
Pehle et al. (2019) investigated the evaluation models of startup companies and identified the dimensions, criteria and indicators of evaluation indicators for startup companies in the idea stage in Iran and extracted the dimensions, criteria and indicators of these companies.
Entrepreneurs often have a false overconfidence not only about their startup but also about their personal influence on outputs and outcomes. They believe that all events and happenings are under their control and luck does not play any role in their success. Here are some of the biases that startup companies face in making decisions:
1- Overconfidence
2- Illusion of control
3- Making conclusions about large statistical societies based only on a small sample
4- Availability bias
5- Persistence and insistence on decisions despite negative results
Another important issue that should be mentioned in the formation of startups and their continuation is the financing process and its cycle. Regardless of the fact that many of the founders finance themselves in the stages of startup formation, in some stages of the startup’s life cycle, there is a need to inject financial resources from outside investors, and this issue plays an important and key role in the success of startups. In this regard, stages such as discovery or idea stage, validation or pre-acceleration stage, construction or acceleration stage, early start stage, growth and maturity can be considered. The important point in mentioning the stages and life cycle of a startup is that each of these stages will have its own special control needs and in order to achieve the strategic and key goals of the organization, special attention should be paid to the control (risks) at different stages of life (Figures 1 and 2).

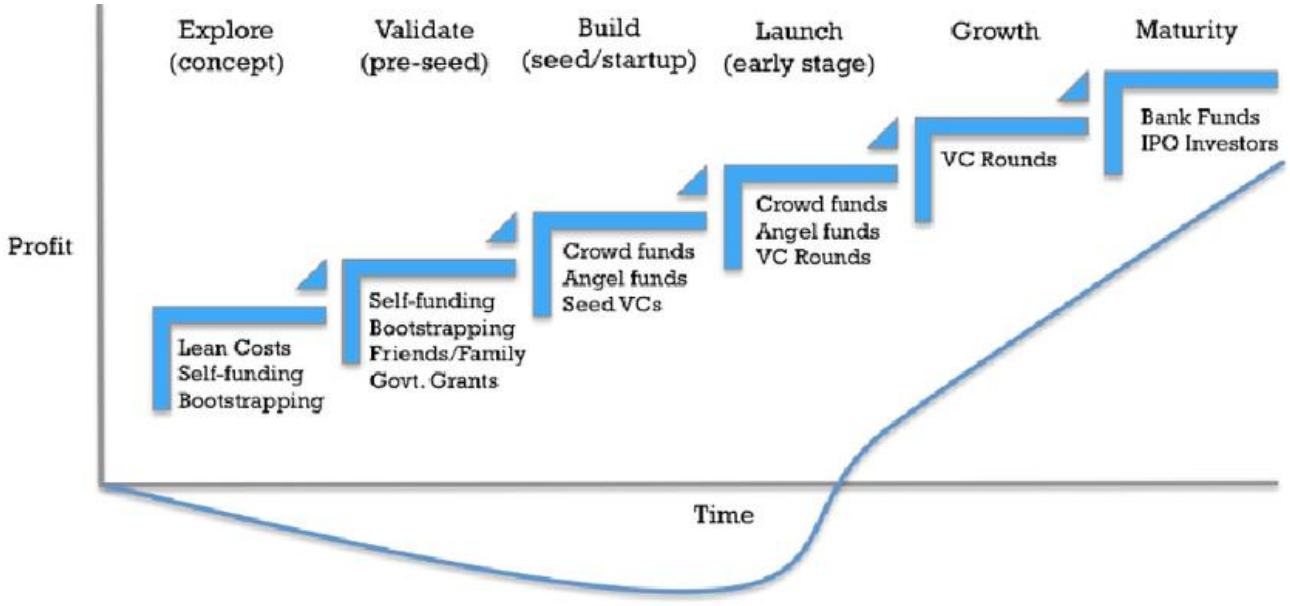

Fig 1. Life stages of a startup (Khashei and Asadi, 2018).

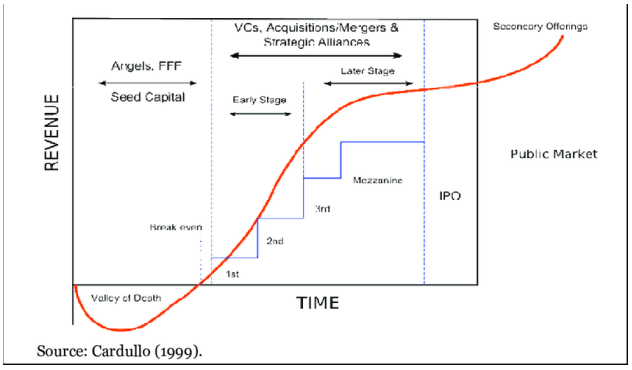

Fig 2. Startup financing cycle (Khashei and Asadi, 2018).

The risks involved in e-commerce transactions have been studied in different reviews and from different perspectives, and different classifications have been presented in this regard. In one of these classifications, risks related to personal information (privacy and security), risks related to product quality and price, risks related to providing customer service, and risks related to business reliability are divided into four areas (Sanei and Bajlan, 2016), an explanation of each of these risks is given below:

A) privacy and security risks

Risks related to personal information in relation to how to protect customers' personal information, both in terms of security (unauthorized agents accessing the seller's server and reading and copying information related to customers) and is maintaining them, as well as in terms of how to use this information. This information includes credit card information and other personal information of customers (Sanei and Bajlan, 2016).

b) Risks in the field of customer service

According to the opinion of "Torabi and Zamani", the risks of this field are: lack of necessary legal and legal rules, lack of necessary guidance for carrying out financial transactions and the possibility of editing and canceling the transaction, lack of a mechanism to deal with customer complaints and problems and deal with them in a timely manner.

c) Risks in the field of the seller

Risks related to business reliability, stability and financial security of the Internet company, the authenticity of the website, the availability of the sales website and the authenticity of the seller's credit certificates are related (Torabi and Zamani, 2015).

d) Risks in the product field

Risks related to the quality and price of the product and service, ensuring that the product and service features match the stated specifications, the price is real and matches the value set on the website (Saenei and Bajlan, 2016).

Today, the structure and environment of information systems in e-commerce websites have become very complex. New threats are also increasing (Zhiwei, 2012).

Studies by the Standish group, which researches the risks of software systems, indicate a high rate of failure in software projects. In several reports of the Standish group, who have conducted research on more than 23,000 projects related to software systems in different years, the results are as follows (Bayat, 2011).

Table 1. Standish group's report on the status of software projects

Percentage of successful projects	The percentage of challenged projects	The percentage of failed projects	year
34	15	51	2002
29	53	18	2004
35	19	46	2006
32	44	24	2008
37	42	21	2010
39	43	18	2012
16.2	52.7	31.1	2014

One of the software systems that need to be implemented with the growth of project-oriented organizations is project management information systems or in short (PMIS), which provides the possibility of managing the information of different projects in organizations at the same time, in a way that the most benefits are included in the organization. In Iran, the implementation of these software systems to solve the problems of project-oriented organizations has been booming for several years, but in many organizations, they have either failed in general or have not provided the expected capabilities (Bayat, 2011). PMBOK defines project risk as follows: "An unexpected event or condition that, if it occurs, has a negative or positive impact on the project's objectives. This definition is an important starting point for understanding project risks". Although the risks resulting from unexpected threats and problems cause stoppage and damage, but the focus of risk management is on the positive side of events and opportunities. Therefore, it is very important to know what could happen to have a positive impact on the project. There are several other definitions for risk, some of which we mention.

A risk is an uncertain event that, if it occurs, has a positive or negative impact on at least one of the project's goals (time, cost, scope, quality). Positive risks are called opportunities and negative risks are threats (J Livari, 1999). The most common definition of risk in software projects is exposure to external factors that threaten to achieve the expected results of a project (Kajkoet al. 2008). Risks are events that can have an adverse effect on the development of projects or the organization's environment (Miguel Waderley al, 2015). The results show that top managers believe that risk-taking is one of the basic and key success factors in decision-making (Mars, Shapira, 1987).

Due to the changes and transformations that occur over time, projects have the possibility of failing to achieve their goals (Kosha, Rafiei, 2014). Therefore, in order to reduce the costs incurred through risks before, during and after (for documentation and use in similar projects), there should be a programmatic project for managing these risks. The sixth edition of PMBOK for project risk management states 7 steps, which in this article is limited to the following steps according to its goals:

1- Risk identification; It means a systematic effort to determine and recognize the threats to the project plan, risk identification is the first step in avoiding risks. One way to identify risk is to prepare a checklist containing the following items:

1-1-Product size: risks related to the overall size of the software.

2-1- Trade effects: restrictions caused by management or the commercial market.

3-1- Customer characteristics: that is, how to communicate with the customer.

4-1- Developing the process.

5-1- Development environment: availability and quality of tools for writing software.

6-1- Manufacturing technology: risks related to the newness of the technology.

7-1- The size and experience of the staff.

In fact, answering these questions allows planners to estimate the impact of risk.

2- Qualitative assessment of risk; Conducting qualitative risk analysis is the process of prioritizing the risks of unique projects for further analysis and further analysis by evaluating the probability of occurrence and its impact and other characteristics. The main advantage of this process is that it focuses on the most important risks.

3- Quantitative risk assessment; Quantitative risk analysis is the process of numerical analysis of the combined effect of identified risks of unique projects and other sources of uncertainty on the goals of the entire project. The main advantage of this process is that it quantifies the total risk of the project and can also provide quantitative

risk information to support risk response planning.
In this article, it is limited to the implementation of risk management to the extent of identifying and prioritizing (qualitative and quantitative assessment) of risks, therefore, this article provides researchers and researchers with the opportunity for many researches and studies in the field of risk management for internet startups. According to the purpose of the article, writing more explanations related to other steps has been avoided.

3- Research method

The ISM technique is based on the definition (Agarwal et al., 2007) of interpretive structural modeling, a technique that enables the investigation of system complexity and shapes the system in a way that is easily understood. Interpretive modeling according to the definition (Warfield, 1974), its originator, is an interactive learning process that structures a set of diverse and related factors in a comprehensive systematized model. According to (Warfield, 1974) and (Fool et al., 2011) to implement the ISM technique in a system, the following process must be followed:
The first step is to determine the variables used in the model. The second step is to determine the type of contextual relationship between the variables, which can be comparative, influential, neutral or temporary.
The third step is to obtain the structural matrix of the internal relationships of the variables (Reachability matrix) so that the dependence between all the identified elements are evaluated two by two and the respondent uses the following symbols to determine the relationships of the variables.
V: Variable I contributes to the realization of variable J.
A: Variable J helps to realize variable I.
X: Variable I and J both help to realize each other.
O: I and J variables are not related to each other.
Table 2. shows the Structural matrix of self-interaction.
The fourth step is to obtain the primary reachability matrix by converting cells of the structural matrix to zero and one.
Table 3. shows the Achievable matrix.
The fifth step is the adaptation of the primary attainable matrix, which is possible in two ways:
1- The initial attainable matrix should be completed many times by experts to make the matrix consistent.
2- Let the initial attainable matrix reach the power of K+1 and consider the K>1 rule based on the Boolean relation.
In this research, the first method is used.
Penetration: Sum of row scores. The variables of this section have the most influence and the least influence.
Dependency: Sum of column scores. The variables of this section have the least effect and the most effect.
Table 4. shows the Final attainable matrix
The sixth step is to determine the level and priority of the variables in the final model. For this purpose, for each of the variables, three attainable final, prerequisite and common sets should be formed. First, the final attainable set and the prerequisite set for each factor should be determined. This is done using the final attainable matrix.
Table 5. is Determining the levels of variables (first iteration)
The seventh step is to obtain a model according to the results of the criteria levels in the tables. Therefore, considering transferability in the final attainable matrix, we draw the model.

4- Research findings

There are various techniques and methods to identify and evaluate the risks of a project, each of which has its own application conditions. Among these methods, some important methods can be mentioned such as “Failure Mode Analysis and Effects (FMEA)” and “Fault Tree Analysis (FTA)” and “Hazard Analysis and Operation Management Technique (HAZOP)” and brainstorming method” and “interview with experts” and etc. In this article, first through interviews with experts, the risks of Internet startup companies were identified and evaluated and prioritized using the interpretive structural modelling technique.
Sampling in qualitative and quantitative research is very different, in quantitative research there is a lot of emphasis on random selection, but in qualitative research, the research sample or participants are selected. Purposive sampling, which is called non-probability or qualitative sampling, means the purposeful selection of research units to acquire knowledge or information (Rangebr et al., 2013). Because the nature of this research is also a qualitative research, therefore, the purposeful sampling method has been used to select the experts.
In this research, using the opinions of experts, the main categories related to internet startup risk and variables were extracted, which are listed in Table 11.
In this article, because the opinions of a group of experts have been used, the mode index was used to determine the initial attainable matrix levels; In this way, for each initial attainable matrix, the relationship that most experts have emphasized was chosen.
At this stage, according to the risks (in the level determination tables) and the relationships between the risks in the final attainable matrix, the structural drawing model is drawn as shown in Figure 3.
The eighth step is the step in which the influence and dependence of each risk variable is determined using analysis. The sum of the row values in the final attain-

able matrix for each element will indicate the degree of penetration and the sum of the columns will indicate the degree of dependence. The factors that are placed in the lower levels of the model will be considered as leaders and the factors that are in higher levels will be considered as followers (Figure 4).

Table 2. Structural matrix of self-interaction.

	C1	C2	C3	C4	C5	C6	C7	C8	C9
C1	-	O	V	V	v	V	X	A	O
C2	O	-	O	A	O	V	A	A	X
C3	A	O	-	X	O	V	A	A	O
C4	A	V	X	-	O	X	X	X	X
C5	A	O	O	O	-	V	A	A	O
C6	A	A	A	X	A	-	A	X	X
C7	X	V	V	X	V	V	-	X	O
C8	V	V	V	X	V	X	X	-	O
C9	O	X	O	X	O	X	O	O	-

Table 3. Achievable matrix.

	C1	C2	C3	C4	C5	C6	C7	C8	C9
C1	1	0	1	1	1	1	1	0	0
C2	0	1	0	0	0	1	0	0	1
C3	1	0	1	1	0	1	0	0	0
C4	0	1	1	1	0	1	0	1	1
C5	0	0	0	0	1	1	0	0	0
C6	1	0	0	1	0	1	0	1	1
C7	1	1	1	1	0	1	1	1	0
C8	1	1	1	1	0	1	1	1	0
C9	0	1	0	1	0	1	0	0	1

Table 4. Final attainable matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	Penetration
C1	1	*1	1	1	1	1	1	*1	*1	9
C2	*1	1	*1	*1	0	1	*1	*1	*1	8
C3	*1	*1	1	1	0	1	*1	*1	*1	8
C4	*1	1	1	1	0	1	*1	*1	1	8
C5	0	0	0	0	1	1	*1	*1	*1	5
C6	*1	*1	*1	1	0	1	*1	1	1	8
C7	1	1	1	1	*1	1	1	1	*1	9
C8	1	1	1	1	*1	1	1	1	*1	9
C9	*1	1	*1	1	0	1	*1	*1	1	8
Dependency	8	8	8	8	4	9	9	9	9	-

Table 5. Determining the levels of variables (first iteration)

Level	Common collection	Prerequisite set	The acquisition set	Abbreviation of risks
	1-2-3-4-6-7-8-9	1-2-3-4-6-7-8-9	1-2-3-4-5-6-7-8-9	C1
1	1-2-3-4-6-7-8-9	1-2-3-4-6-7-8-9	1-2-3-4-6-7-8-9	C2
	1-2-3-4-6-7-8-9	1-2-3-4-6-7-8-9	1-2-3-4-6-7-8-9	C3
	1-2-3-4-6-7-8-9	1-2-3-4-6-7-8-9	1-2-3-4-6-7-8-9	C4
	8-7-5	8-7-5-1	9-8-7-6-5	C5
	1-2-3-4-6-7-8-9	1-2-3-4-5-6-7-8-9	1-2-3-4-6-7-8-9	C6
	1-2-3-4-5-6-7-8-9	1-2-3-4-5-6-7-8-9	1-2-3-4-5-6-7-8-9	C7
	1-2-3-4-5-6-7-8-9	1-2-3-4-5-6-7-8-9	1-2-3-4-5-6-7-8-9	C8
	1-2-3-4-6-7-8-9	1-2-3-4-5-6-7-8-9	1-2-3-4-6-7-8-9	C9

Table 6. Determining the levels of variables (2nd repetition)

Level	Common collection	Prerequisite set	The acquisition set	Abbreviation of risks
	1-3-4-6-7-8-9	1-3-4-6-7-8-9	1-3-4-5-6-7-8-9	C1
2	1-3-4-6-7-8-9	1-3-4-6-7-8-9	1-3-4-6-7-8-9	C3
2	1-3-4-6-7-8-9	1-3-4-6-7-8-9	1-3-4-6-7-8-9	C4
	8-7-5	8-7-5-1	9-8-7-6-5	C5
2	1-3-4-6-7-8-9	1-3-4-5-6-7-8-9	1-3-4-6-7-8-9	C6
2	1-3-4-5-6-7-8-9	1-3-4-5-6-7-8-9	1-3-4-5-6-7-8-9	C7
2	1-3-4-5-6-7-8-9	1-3-4-5-6-7-8-9	1-3-4-5-6-7-8-9	C8
2	1-3-4-6-7-8-9	1-3-4-6-7-8-9	1-3-4-6-7-8-9	C9

Table 7. Determining the levels of variables (third iteration)

Level	Common collection	Prerequisite set	The acquisition set	Abbreviation of risks
3	1	1	5-1	C1
	5	5-1	5	C5

Table 8. Determining the levels of variables (fourth repetition)

Level	Common collection	Prerequisite set	The acquisition set	Abbreviation of risks
4	5	5	5	C5

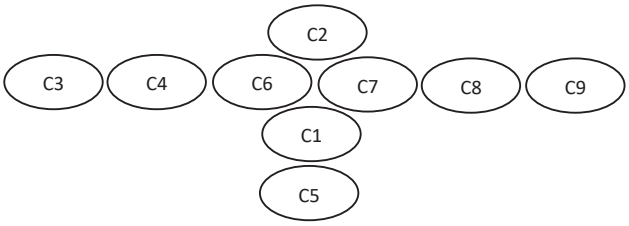

Fig 3. Interpretive structural modelling of Internet startup companies' risks

The graph of influence-dependency analysis is divided into 4 parts:
1- Autonomous: factors with low influence and low dependence; Region 3 of the table
2- Dependent: factors with low influence and high dependence; Region 4 of the table
3- Connected (link): factors with high influence and high dependence; Region 1 of the table
4- Independent: factors with high influence and low dependence; Region 2 of the table

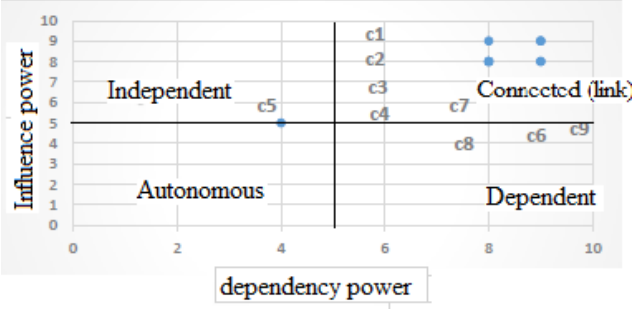

Fig 4. Influence and dependency power analysis chart (MICMAC analysis)

Through interviews with experts and literature review, 12 risks were stated for Internet startup companies, but with some corrections and final approval of experts, 9 risks were identified as decisive and main risks, as shown in Table 9. Most of the risks are related to the field of information technology, that is, the quality, speed and impenetrability of the system and software that the company uses to provide services. The information of the experts who were interviewed in this research is specified and presented as described in Table 9. The experts in the field of Internet startup companies were IT students, top entrepreneurs in the Internet business field, and software managers and leaders of several startups.

Table 9. Information about the interviewed experts

Area of Expertise	Professional activity experience	The age of experts	Number of experts	Grade
Information Technology	20-17	48-37	5	P.H.D
Information Technology	10-8	35-27	6	Masters
Information Technology	5-3	33-26	2	Bachelor's degree

In general, the origin and risk factors of software projects in the field of information technology can depend on various factors, some of which are mentioned in Table 10:

Table 10. Origin of risk and description of risk

Description of risk	The origin of risk of Internet startup companies
Risks that result if information technology is ineffective, such as software or hardware equipment	Technology
Risks caused by people including users, project team, company employees, etc	People
Risks arising from the organization (company) such as lack of commitment, change of management, etc	Organizational
Risks caused by the tools used	Tools
Risks caused by not correctly identifying requirements and major changes in them	Requirements
Risks caused by correct estimation of time and cost	Estimates
Risks caused by legal, legal issues and etc	legal
Risks caused by incorrect and wrong processes	Process
Risks arising from the business environment	environmental

.The need for project risk management is inevitable due to the increase in complexity, project volume, competition and other economic and political issues. Since it is not possible to manage and respond to all identified risks, after identifying project risks, it is necessary and necessary to evaluate and prioritize these risks to manage and respond to them. The presence of risk in the project indicates that there is uncertainty in the space of project execution and implementation.

Table 11. Identified risks of Internet startup companies

Type of risk effect	The origin of risk	Risks	Abbreviation of risk
Product and business	Technology	Failure of information systems related to the used software	C1
Business	Process	Failure to apply the appropriate policy and procedure to collect access fees from users	C2
Product and business	Technology and tools	The low efficiency of the produced software and the time interval from the moment of activation to the expected result	C3
Product and business	people	The lack of user-friendliness of the software provided by the startup company	C4
Project and business	Technology and people	Theft of user information in the network	C5
Project and business	Estimates and people	Losing market competition with the entry of new competitors	C6
Product and business	people	Failure to employ experts and experts in the company	C7
Project and business	people	Withdrawal of skilled and experienced people from the project team	C8
Project and business	environmental	Changing user tastes and updating facilities	C9

The purpose of this research is to identify and prioritize the risks of Internet startup companies. According to the opinion of experts in this field, 9 main risks were confirmed and selected. Then, in order to analyze the relationships between risks and provide a structural model, the interpretive structural modeling method was used. According to the results of the analysis, "Theft of users' information in the network" has the greatest effect on the challenges and risks of startup companies.

In general, after reaching a final interpretative structural modelling in this article, the following results were obtained:

The model resulting from the research is divided into 4 levels, so that the more we move to the higher levels of the model, the less effective the risks will be. Therefore, at the first level, the risk of "theft of users' information within the network" is placed, and at the second level, the risk of "failure (or weakening) of the information systems related to the used software" is placed, which have the greatest impact on other risks.

On the other hand, at the highest level, the risk of "not applying the appropriate policy and procedure to collect access fees from users" is placed. In other words, as the risks go to higher levels, their power of influence (stimulation) is lower and their influence (dependency) is higher.

The first area of Figure 4 is the location of risks that are isolated from the system, that is, they have both low stimulus power and low dependence power, and do not include any of the presented risks. In other words, there is a very strong relationship between risks.

The second region of Figure 4 is the location of risks that

have low stimulation and high dependence on the occurrence of other risks and do not include any of the presented risks.

The third region of Figure 4 is the location of risks with high stimulating power and high dependence power on the occurrence of other risks. All the risks examined in this research except the C5 risk (theft of users' information in the network) are located in this area.

The fourth region of Figure 4 is the location of risks that affect all risks, such as the risk of "theft of users' information in the network".

The result of this research is identifying and prioritizing the risk of Internet startup companies as well as the relationships between them, and makes the senior managers of Internet companies aware of the risks related to their business so that they can adopt appropriate plans and solutions to deal with risks and challenges.

The results show that all the risks identified by the experts are critical risks, and the managers of startup companies should focus more on these risks, and adopt solutions and mechanisms that prevent the escalation of other risks. Because there is a high stimulating power in every risk. Therefore, a suitable strategy should be considered to reduce or minimize the effect of each risk.

For future research, it is suggested that the risks be analyzed from the perspective of threat and opportunity, and for each of the identified risks, countermeasures for threats and escalating solutions for opportunities are presented.

In future research, researchers can identify risks based on other project management standards and compare these standards. Also, use this approach in other types of projects.

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Consent for publication
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Competing interests
The authors declare that they have no competing interests.

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6- Resources

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