International Journal of Information Science and Management
Vol. 20, No. 2, 2022, 145-165
https://dorl.net/dor/20.1001.1.20088302.2022.20.2.9.4

Original Research

Technology Startups and University-Based Entrepreneurial Ecosystems in the Universities of Golestan Province

Elahe Masoumi
Ph.D. Candidate, Department of Entrepreneurship, Islamic Azad University, Sari Branch, Sari, Iran.
masoumi@yahoo.com
ORCID iD: https://orcod.org/0000-0002-9452-1143

Mohammad Salehi
Associate Prof., Human Sciences Faculty, Department of Educational Management, Sari Branch, Islamic Azad University, Sari, Iran.
Corresponding Author: drsalehi@iausari.ac.ir
ORCID iD: https://orcid.org/0000-0001-8127-8570

Maryam Taghvaeeyazdi
Associate Prof., Depart University, Sari Branch, Sari, Iran.
m_taghvaeeyazdi@yahoo.com
ORCID iD: https://orcid.org/0000-0003-0066-7078

Received: 07 November 2020
Accepted: 02 August 2021

Abstract

University startup accelerator programs have exponentially increased over the past decade; however, their role in the university entrepreneurial ecosystem is ambiguous. This research aims to determine the Effectiveness of Technological Startups on University Entrepreneurship Ecosystems by Rough Set Theory. This is particularly the case when entrepreneurship education (EE) integration is considered, raising questions about such startup enablers' validity, measurement, and outcomes. The target population in the qualitative section was similar research and academic experts at the entrepreneurial level. However, the target population in the qualitative section, 20 managers and deputies at various academic levels in Golestan province, were analyzed according to the requirement Rough theory; much of the population is acceptable. In this study, 9 research proposals for the development of technological startups and 5 components of the entrepreneurial ecosystem at the university level were determined by screening selected studies. Due to the confirmation of the theoretical adequacy limit based on Delphi analysis, they entered the analysis phase of Rough Theory. The results showed that the most effective role of the university as an entrepreneurial ecosystem is to strengthen the level of educational and research functions. If the educational and research functions in entrepreneurial ecosystems move towards technology, it can connect industry with the university and provide the basis for sustainable development.

Keywords: Technological Startups, University Entrepreneurship Ecosystems, entrepreneurship education, Golestan Province.

Introduction

The impact of technological innovation and globalization on economic development and job creation is being felt worldwide, resulting in the growing interest in nurturing and sustaining regional entrepreneurial ecosystems (Huang-Saad et al., 2018). Given the role public universities play in developing technological innovations and meeting the human capital needs of their regions and society more generally, academic institutions have bolstered investments in complex networks of entities to support technology commercialization and entrepreneurship

education (Belitski and Heron, 2017). These entities include entrepreneurship centers, technology transfer offices, business incubators, clubs, and networking organizations designed to support student and faculty innovators interested in commercializing research and/or bringing products to market. These initiatives often include the support and involvement of regional industry leaders, economic development professionals, and state and local government (Maritz et al, 2022). Entrepreneurial ecosystems are defined as a close partnership between individuals, the government, and its associated institutions and other effective components that promote entrepreneurial activities in a certain situation, either a university or an economic environment. However, the objective is to improve perceptions toward employment and entrepreneurship (Thomsen et al., 2018). It is remarkable that, in any case, the presence of ecosystems can play an effective role in economic development and institutionalize entrepreneurial cultural practices in the society in question, both in terms of cultural elements and social values. According to this approach, the university as an ecosystem organizes and guides entrepreneurial practices in the form of investor support as a learner. Adopting public policy in this area promotes government agencies as leverage to facilitate the use of advanced and multidimensional economic development technologies by entrepreneurship dynamics. Despite existing studies emphasizing the importance of integrating entrepreneurial and strategic thinking, underscoring how capabilities are critical for exploiting business opportunities (Agarwal et al., 2010; Liao and Phan, 2016), these and other issues are surprisingly underexplored in the context of technology entrepreneurship (Lamine et al., 2018). As a prominent theorist in this field, Eisenberg (2010) notes that an entrepreneurial ecosystem cannot be applied in other fields or areas since it is interconnected with a society's cultural, economic, social, political, and indigenous criteria or a particular circumstance such as a university. Accordingly, the ecosystem of a certain defined situation is distinct. In developing entrepreneurial ecosystems, though, the problem that has been less discussed is the development of technology to make them more effective. In other words, while more than twenty years have passed since the creation of the term "ecosystem" (Moore, 1993), this approach has not been specifically conceptualized in the area of technology entrepreneurship so far (Elia et al., 2020). At the beginning of this century, ecosystems have been produced more seriously in technology entrepreneurship at universities to further exploit knowledge and develop sustainable infrastructure, including recognizing technological and localized opportunities to raise productivity. Therefore, setting the stage for the formation and development of a university-based technology entrepreneurial ecosystem would contribute to the growth of opportunity-based (pull) entrepreneurship and will have a significant positive impact on economic growth to achieve sustainability. Notably, the first discussion on developing a U-BEE centered on adjusting the thought and approach to mere education and research at the university originated in Etzkowitz's entrepreneurial approach in 1983. However, the focus is on technological practices since the beginning of this century to improve entrepreneurship in the form of university-based ecosystems. The majority of top-ranking universities around the world have formulated long-term strategies in this regard. In Iran, however, this problem has not been generated in the form of programs and policies because it has not encouraged the degree of importance of entrepreneurship in the education and research system and the lack of budget funding, especially in recent years, despite attempts to rely on economic and political opposition. However, the university only has a limited share of entrepreneurship, especially technology entrepreneurship, in this respect. While there are considerable scientific resources

and skills in the region, these resources are quickly missed due to the lack of proper management. The university-based ecosystem practices play little role in entrepreneurship. Therefore, considering the difference between the theoretical meaning and the deployment of entrepreneurial ecosystems in university technology, this thesis aims to define the requirements for the growth of startups in technology through university-based entrepreneurial ecosystems (U-BEEs). Therefore, this research aims to establish startups in technology focused on university entrepreneurial ecosystems, based on the review of rough set theories.

Literature Review

Entrepreneurial ecosystem

The term ecosystem originated from biology and is defined as a system that includes living organisms and a physical environment functioning together as a whole (Rice et al., 2014). Social science researchers began to use the term "ecosystem" as it appropriately describes the nature of and complex interaction of economic communities that operate based on the interaction of individuals, roles, infrastructure, organizations (business and government), and events (Bloom and Dees, 2008). Valdez (1988) appears to be the first researcher to document the term entrepreneurial ecosystem in a paper presented at the Small Business Institute Director's Association conference 1988. In this paper, he adapted the ecosystem model to entrepreneurship and developed a theoretical framework for understanding new business formation. Moore (1993) first used the term ecosystem to describe the business as an economic community sustained in the business world involving organizations, persons, and communities. One of the first scholars to use the term entrepreneurial ecosystem in his informal research paper was Valdes (1998). By embracing an approach based on entrepreneurial personality traits and their effect on the ecosystem, pointing to the factors involved in startup development, including talented entrepreneurs, environmental circumstances, and business conditions, he presents the entrepreneur as an individual with diverse opportunities and capital. Nick et al. (2004) proposed the central concept of the entrepreneurial ecosystem as a set of basic and essential components for entrepreneurial practices that are intricately interconnected, such as leadership, community, financial resources, and money. In his opinion, the market ecosystem's general components are included in Figure 1.

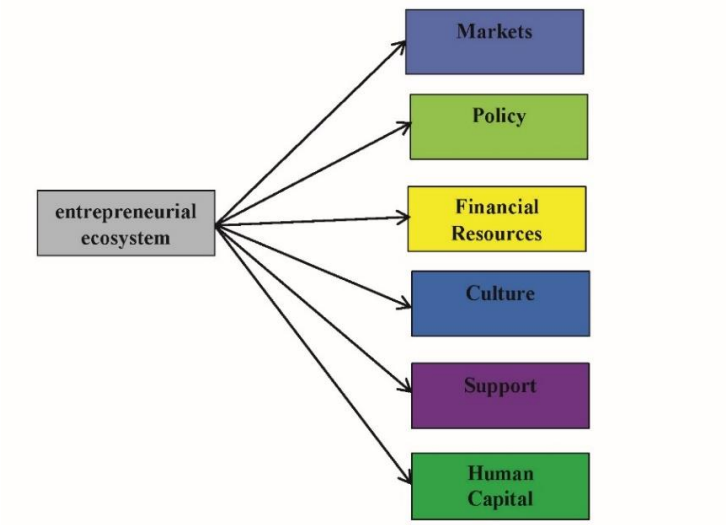

Figure 1: General Components of the Entrepreneurial Ecosystem

These dimensions are divided into 1) politics (including leadership and government), 2) financial resources, 3) culture (including entrepreneurial success stories and social norms), 4) funding for infrastructure, 5) human capital (including education and staff), and 6) markets (including networks and primary customers), which are usually composed of technological and non-professional capital, On the other hand, McCain (2013) described three dimensions of the market ecosystem.

This framework aims to achieve entrepreneurial efficiency by analyzing the effect on developing the entrepreneurial ecosystem of individual and environmental factors and each ecosystem-forming structure. The efficiency for which a framework is built in the business environment (Entezari, 2015). It is important to remember that it takes an ecosystem to encourage entrepreneurship. Such a framework often needs a high degree of engagement, including organizations, entities, and systems, to build mutually beneficial and autonomous entrepreneurial activity (Berger and Cokertz, 2016). Some of the proposed entrepreneurial ecosystem components developed by leading researchers in the field are shown in Table 1.

Table 1

Proposed components of entrepreneurship ecosystem (Source: Heidari et al., 2009)

Researchers	Components
Gynawali & Fogel (1994)	Government policies and procedures; Political-economic factors; Entrepreneurship and business skills; Financial and non-financial assistance
Valdez & Richardson (1998)	Environmental characteristics, resources (capital, land, facilities), market effects, personal characteristics of the individual (entrepreneur)
Isenberg (2010)	Markets, politics, human capital, protections, culture, financing
Feld (2012)	Cultural Support, Universities, Education, Legal Framework and Legal Infrastructure, System Trainers and Consultants, Labor and Human Capital, Accessible Markets
Spigel (2015)	Supportive culture, Entrepreneurs background, Networks, Individual talent, Investment force, Policies, Universities, Free markets, Support system

University-based Entrepreneurial Ecosystem

The university-based entrepreneurial ecosystem applies information and technology-related motives to promote a nation's macro priorities and the degree of knowledge development related to awareness-taking practices and abilities to integrate intellectual properties and resources into every culture (Padillamellands et al., 2020). Values extracted from information at the entrepreneurial ecosystem-level focus on modifying and altering approaches and redesigning social and economic strategies and structures that help increase dynamism and increase entrepreneurial learning level for problem-solving growth. Notably, the combination of information at the technological level is not adequate merely to influence the operation and translate it into simple knowledge. Knowledge must contribute to improved expertise and learning at problem-solving (Entezari, 2009). The following is based on the structure development structure suggested by Pool and Van Itallie (2013) for the university-based entrepreneurial ecosystem (Figure 2).

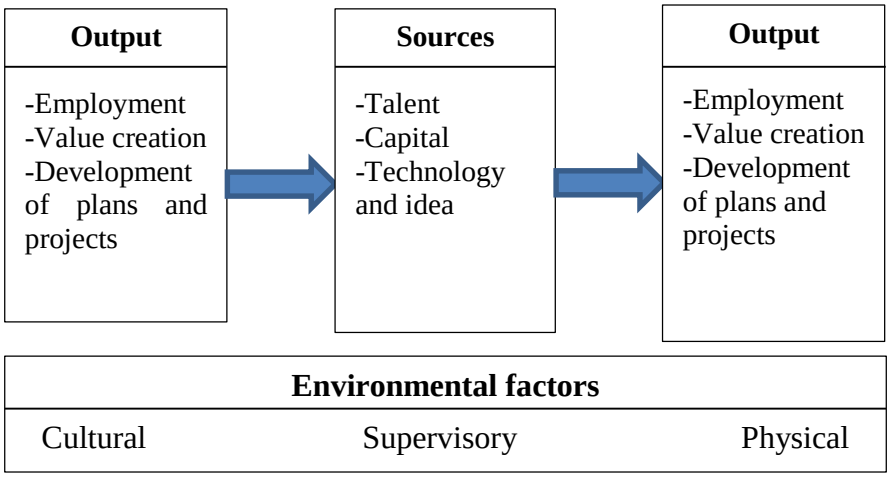

Figure 2: The System Framework of the University-Based Entrepreneurial Ecosystem

Centered on this framework, the knowledge acquisition-based relationship between entrepreneurship and the university-based ecosystem continues to the degree that the fusion of these two approaches will provide a foundation for the socialization of entrepreneurship in any economy and reinforce people of any society as prominent players in entrepreneurship. In other words, this structure allows partners to improve the feasibility of generating innovative innovations in a society based on the university's two-way partnership with entrepreneurship (Fernandez et al., 2015). The university-oriented entrepreneurial ecosystem produces an interconnected and competitive community based on this methodology. While having a successful entrepreneurship capacity, it has a range of creative approaches and expectations that make institutions and organizations successively interdependent with economic forces, i.e., markets. To draw further funding, they establish legal structures and increase dynamic entrepreneurship (Thomsen et al., 2018).

Technology Entrepreneurship

In the technology entrepreneurship literature, two major approaches can be identified for investigating the characteristics of the technology entrepreneur (TEs). The first aims to identify traits of the TEs, while the second intends to explain their success based on competence. The first approach uses traits to explain the success of TEs. Characteristics like “high need for achievement” and “moderate need for power” (Abou-Warda, 2016), “need for autonomy” and “locus of control” (Baradaran, 2020), and “endurance” and “commitment” (Yang et al., 2015) are supposed to influence on business creation and development. However, the findings in this area are conflicting and have been found to have a less certain impact on entrepreneurial outcomes (Wright et al., 2007). Furthermore, it can be argued that the intended findings offer limited possibilities to improve business creation and development since traits are perceived as fairly steady (McHenry, 2008).

The second, the competence approach to entrepreneurship, takes a broader perspective by investigating competence as qualifications for success (Yáñez-Valdés, 2021). The notion of competence has received extensive consideration across a varied mix of fields and areas (Morris et al., 2013). Bird (1995) validates the application of the competence approach in the entrepreneurial setting, concluding that competence can represent both a baseline for the

creation and development of a business and a higher standard for achieving sustainability and growth. In this view, traits are a part of competence. So, TE's competence as a concept has gradually moved away from trait-based description toward a multi-dimensional view by considering knowledge, skills, and attitudes. For example, Sanchez and Perez (1998) have addressed the issue of competence and stated that having a self-employed father, a high education degree, and at least 9 years of experience before setting up the business are the three major factors to success. They stated that although general and specific human capital is essential, less information from TEs about ways to serve a market increases the possibility of using technological knowledge by them for creating breakthrough innovations. Also, Marvel and Droege (2010) emphasized the role of different kinds of knowledge and reiterated that previous experience in developing products and services is vital for a successful new technology-based firm. Furthermore, it is said that previous funding experience is positively related to the crowdfunding achievement of TEs (Ceballos et al., 2017).

Development of Startups based on Technology Entrepreneurship

With early research dated back to the 1980s and 1990s, pioneering works on the entrepreneurial ecosystem attempted to shift the focus from being entrepreneur-centric to incorporating the impact of the larger community and environment on entrepreneurship processes (Stam and van de Ven, 2019), consequently, bridging different domains and theoretical lenses, such as economically sustainable development, entrepreneurial management (Kang et al., 2021), innovation and (regional) economic development (Wurth et al., 2021). Since then, there has been an increasing interest among researchers, entrepreneurs, practitioners, and policymakers in entrepreneurial ecosystems over the past decades (Maroufkhani et al., 2018; Wurth et al., 2021). The emerging concept can be defined as “a set of interdependent actors and factors coordinated so that they enable productive entrepreneurship within a particular territory” (Stam, 2015). Strwalder often characterizes startups as two-dimensional, based on values such as the reach of entrepreneurs' vision, the specialized goal, founders, and the target market (Bask et al., 2010). It can be claimed that startups are currently a reliable source of innovation information by learning more about startups in the meanings given and have increasingly become a source of innovation with the growth of entrepreneurial infrastructure since they are evolving innovations in the direction of inventing new goods and business models (Darunitsky and Lennox, 2005). Therefore, as an ecosystem base following an open innovation approach, entrepreneurship growth agencies continuously see startups as a conduit of external innovation for knowledge development and a sustainable economy (Meysamy et al., 2017). To raise the level of aspirations in today's social life, the Digital Economy Technology Growth Headquarters and the Vice President for Research and Technology have signed contracts and memorandums of understanding, taking into account the value of developing technological startups in the context of entrepreneurial ecosystems in the country over the past few years. Collaboration has sought to foster and grow this aspect of entrepreneurship and has devised policies and plans in this area through the growth of knowledge-based technology and to develop the university's relationship with industry, commerce, and economics. Unfortunately, not much progress has been made in this field due to the absence of experimental research and the distance between hypotheses and implementations. It is important to acquire more knowledge about adopting the best ecosystem strategies by modifying study approaches. In this respect, in the form of a rough set analysis,

this study seeks to identify, on the one hand, the development-oriented propositions of technological startups and, on the other hand, the components of entrepreneurial ecosystems at the university level, while at the same time recognizing the most important propositions of technological startups tailored to social needs, to select the best strategies. The entrepreneurship ecosystem of the university is for technology startups to grow.

Materials and Methods

Given three fundamental results, it is important to determine the purpose and form of data in the study's methodology. This study is treated as results-driven developmental research since the principles relating to the creation of technological startups driven by U-BEEs do not, in principle, have a coherent structure. The research aims to develop the theoretical basis of this concept in entrepreneurial ecosystems, and, from this perspective, it is considered development. Centered on the intent, this study is also among the descriptive studies to describe the desired phenomena at the university entrepreneurship level. Finally, the data set is inductive-deductive in terms of rationale since theoretical foundations of technology startups and entrepreneurial economies are studied in the qualitative section, first based on an inductive method and then clarified based on deductive components propositions. Meta-synthesis is used in this analysis, a hybrid study, in the qualitative component. Meta-synthesis entails steps to arrive at elements and propositions, perhaps the most important of which are the method steps of Sandelowski & Barroso (2008), ranging from identifying the root cause of the issue in the context of a research query to presenting a specific model focused on the recognition of research findings components and propositions. The history is covered by the presence of members of the jury. An effort is then made to evaluate the ideas back and forth between experts, based on the Delphi study, to assess the theoretical adequacy according to the two parameters of average and coefficient of concordance. Finally, in the quantitative section, the most successful propositions found are calculated in the context of a hierarchical model by the study of rough theories.

Statistical population and sampling method

This study's statistical population consists of two parts: the qualitative and quantitative sections. In the qualitative part, the target audience involves functional studies on research topics and 16 university-level entrepreneurship experts interested in studying and identifying startup content ideas and components of the university entrepreneurship ecosystem based on the meta-synthesis framework, critical assessment, and Delphi analysis. A homogeneous qualitative sampling approach was used in the context of panel community participants to select these individuals. The researcher chooses his/her samples in this sampling system to acquire intensely, distilled, and thorough expertise from those who have encountered this phenomenon and provide the researcher with much information. (Sadeghi-Fasaei & Naseri-Rad, 2012). However, the Golestan's target population was a limited number of 20 managers and deputies at various university levels, appropriate to the statistical population because of the Rough Theory Research criterion because the purpose of this community's involvement is to explain the quality sector's results at the university entrepreneurship ecosystem's policies and strategies. Since this approach is an analysis focused on the analysis of complex structures at some stages, which should be focused on particular criteria, such as participants' knowledge or competence, which, due to the lack of certain nonsensical responses, allows up to 30 persons to engage in the cross-matrix questionnaire. The optimum sample size allocation in the range of 15 to 25 individuals was projected by researchers such as Zhang et al. (2016), Shyng et al. (2007), and

Pavlak (2005) and based the allocation of the sample population on the available sampling tool according to the filters in line with the design of the analysis

Research validity

The content validity ratio (CVR) was used to validate the validity of the constructed questionnaires, based on which ten-panel members were asked to fulfill three "important" criteria; to determine "useful but not appropriate" and "unnecessary" claims. To affirm the study's validity, each researcher selected one of the above three choices. All the propositions were determined to be above the set standard (CVR) and were approved.

Results

Meta-analysis and Delphi findings

It was first used via databases and research references to perform meta-synthesis. For this reason, the study in this section aims to examine the components relevant to the U-BEE and the propositions for technological startup growth, depending on the method of meta-analysis and Delphi analysis. The following databases and academic references are used to derive similar research related to the research subject.

Table 2

Information data banks and official research references

Internal databases	External databases
MAGIRAN	Sciencedirect
NOORSOFR	Emeraldinsight
SID	OnlineLierary

According to the protocol and the hyper-combination assessment process, a range of relevant and accurate study studies was found from 2016 to 2020 and 2017 to 2019. The study relevant to the research purpose was defined to identify comparable papers and inquiries and use the above research bases and sources (Figure 3).

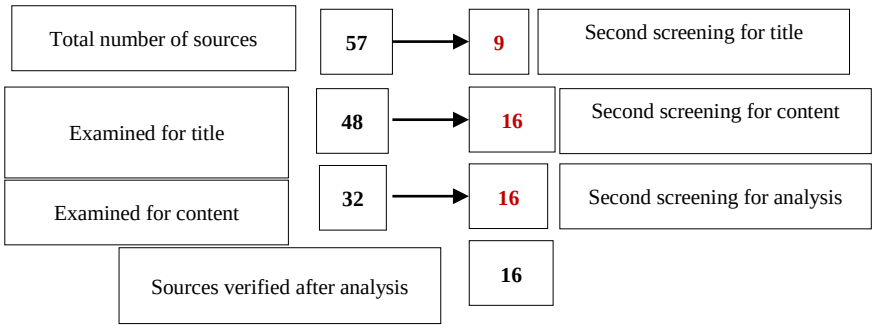

Figure3: Screening Analysis of Research Proportionate

Based on three aspects of the title, content, and review of the study screening, it was decided that 16 research studies should be used as a basis for assessment to define the components of the university entrepreneurship ecosystem and the propositions for technological startup growth. Following this stage, the themes were classified and divided into components and propositions in the next process, based on the Stirling (2001) methodology. According to this

approach, with the aid of 16 research experts, the first 15 studies were accepted by ten critical assessment method criteria, including research goals, research method reasoning, research architecture, sampling, data processing, reflectivity, analytical precision, theoretical and transparent expression of findings and research importance, are prepared to achieve a more coherent understanding Action is taken separately to create a more coherent understanding of identifying components and propositions.

A) Identifying the propositions for the development of technological startups (x)

Propositions relating to technological startups' growth are decided in this section, based on the Stirling (2001) process, based on the meta-synthesis and critical assessment scale.

Table 3

The evaluation process of approved researches to determine the development propositions of technological startups

Research location / Evaluation criteria	External research						Internal research		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Critical evaluation criteria/Research	Xu, Zhang & Chen (2020)	Kim, Kim & Sohn (2020)	Oliva & Kotabe (2019)	Park & Park (2018)	Spender, Corvello, Grimaldi & Rippa. (2017)	Pattnaik & Pandey (2017)	Shahrabi, Ashrafi & abbasi (2019)	Nasrollahi, Fathi & Shoshpari (2019)	Bandarian (2018)
Research objective	2	3	5	3	3	3	3	4	3
Methodological rationale	2	4	4	3	3	4	5	5	3
Research design	2	3	3	3	3	3	4	4	4
Sampling method	3	4	3	2	4	3	3	4	3
Collection method	2	3	4	3	3	3	4	4	4
Generalization of the findings	2	4	5	2	4	3	3	4	3
Ethical	2	3	4	2	4	3	3	4	4
Statistical analysis method	2	3	4	3	3	3	3	3	4
Theoretical capability	2	3	4	4	4	2	4	4	3
Research value	3	4	5	3	4	3	4	5	3
Total	**22**	**26**	**41**	**28**	**34**	**32**	**36**	**43**	**35**

Based on this analysis's findings, it was observed that two experiments that did not achieve the necessary ranking, Xu et al. (2020), and Park and Park (2018), were thus omitted from the analysis. Then, the research topics are extracted using the Stirling (2001) method. Therefore, to evaluate the production ideas of technological startups, the following scoring system is used. Based on this method, all the sub-criteria extracted from the text of the approved articles are written in the table column, and then the names of the approved researchers are given in the table row. Based on the use of the sub-criteria written in the table column by each researcher, the symbol '□' is introduced, so the scores of each □ are added together in the sub-criteria column, and the scores above the test average are used as propositions for startup technology growth (Table 3).

Based on this report, nine propositions (Financing, Institutional support, Technological needs, Identifying opportunities and threats, User-accepted, Formulation of appropriate strategies, Identifying the target market, Using communication and information channels, Identifying competitors) were found to have the highest frequency of 7 accepted research projects (Table 4). The 7-point Likert scale was used for ranking. Based on this review, they are considered the key criterion for evaluating the startup technology growth propositions. After examining the accepted study's theoretical foundations, this section decided on the desired propositions.

Table 4
Analysis of propositions for the development of technological startups

Researchers	Financing	Institutional support	Networking	Technological needs	Identifying opportunities and threats	User-accepted	Formulation of appropriate strategies	Identifying the target market	Using communication and information channels	Conforming to culture and social norms	Strengthening ways of interaction with stakeholders	Identifying competitors
Kim et al. (2020)	☑	☑	☑	-	☑	☑	☑		☑	☑	-	☑
Oliva & Kotabe (2019)	☑	-	-	☑	☑	-	☑	☑	☑	-	-	☑
Spender et al. (2017)	-	☑	-	☑	-	☑	-	☑	-	-	☑	-
Pattnaik & Pandey (2017)	-	☑	☑	☑	☑	☑	-	☑	☑	☑	-	☑
Shahrabi et al. (2019)	☑	-	-	-	-	-	☑	-	-	-	-	-
Nasrollahi et al. (2019)	☑	☑	-	☑	☑	-	☑	☑	☑	-	-	☑
Bandarian (2018)	☑	☑	-	☑	☑	☑	☑	☑	☑	-	-	☑
Total	**5**	**5**	**2**	**6**	**5**	**4**	**5**	**5**	**5**	**2**	**1**	**5**

B) Identifying the components of entrepreneurial ecosystems at the university level (y)

The components of enterprise ecosystems are measured based on the essential assessment scale at a university level to draw the elements correlated with enterprise ecosystems (law in the rough analysis process)

Table 5

The evaluation process of approved research to determine the components of the U-BEE

Research location / Evaluation criteria	External research					Internal research	
	1	2	3	4	5	6	7
Critical evaluation criteria/Research	Elia et al. (2020)	Ali Ali, Ali & Badghish (2019)	Tripathi et al. (2019)	Thomsen et al. (2018)	Asses et al. (2017)	Kordheidari et al. (2019)	Maysami i et al. (2018)
Research objective	4	3	3	3	3	3	4
Methodological rationale	3	3	2	3	4	3	4
Research design	4	4	1	3	3	3	3
Sampling method	4	3	1	3	3	3	4
Collection method	4	3	2	4	3	4	4
Generalization of the findings	4	3	3	3	3	3	4
Ethical	5	4	2	3	3	4	3
Statistical analysis method	4	4	1	4	3	4	4
Theoretical capability	4	3	2	4	4	4	4
Research value	4	4	2	3	3	4	4
Total	40	34	19	33	32	35	38

The findings revealed that only the Tripathi, Ovivo, Liukkunen & Markkula (2019) experiments were omitted because of a lower score of 30 based on the results of this study (Table 6). Then the components of the study can be decided, such as the point at which propositions to grow startups can be decided.

Table 6

Analysis of the components of the U-BEE

Research location	Researchers	Strategic practices	Capital practices	Cultural practices	Marketing practices	Innovation practices	Educational and research practices	Learner practices
External	Elia et al. (2020)	-	☑	☑	-	☑	☑	-
	Ali et al. (2019)	-	-	-	☑	☑	☑	-
	Thomsen et al. (2018)	☑	☑	-	☑	-	☑	-
	Asses et al. (2017)	☑	☑	-	☑	-	☑	☑
Internal	Kordheidari et al. (2019)	☑	-	-	-	☑	-	-
	Maysami et al. (2018)	☑	☑	-	☑	☑	☑	-
Total		**4**	**4**	**1**	**4**	**4**	**5**	**1**

The five roles in entrepreneurial ecosystems (strategic practices, capital practices, cultural practices, innovation practices, educational, and research practices) as the basis for technology startups' growth are examined based on accepted studies' screening (Table 7). The 7-point Likert scale was used for ranking.

Delphi analysis was used to reach the theory of saturation as a fixed and designated feature of entrepreneurial ecosystems at the university level to assess the reliability and generality of technological beginning growth propositions. These statements and components have been made available to experts using a checklist of seven survey alternatives, the findings of a Delphi analysis being seen in Table7.

Table 7
First-round Delphi analysis process

Objective	Elements	Mean	Coefficient of concordance	Confirmed ☑	Result
Components	Strategic practices	5	0.65	☑	Confirmed
	Capital practices	6	0.90	☑	Confirmed
	Marketing practices	5.10	0.75	☑	Confirmed
	Innovation practices	5.20	0.80	☑	Confirmed
	Educational and research practices	5	0.65	☑	Confirmed
Propositions	Financing	5.10	0.75	☑	Confirmed
	Institutional support	5.20	0.80	☑	Confirmed
	Technological needs	5.10	0.75	☑	Confirmed
	Identifying opportunities and threats	5.10	0.75	☑	Confirmed
	User-accepted	5	0.55	☑	Confirmed
	Formulation of appropriate strategies	6	0.90	☑	Confirmed
	Identifying target market	5.20	0.82	☑	Confirmed
	Using communication and information channels	5.10	0.75	☑	Confirmed
	Identifying competitors	5	0.55	☑	Confirmed

Thanks to testing professionals as panel participants, we know that all elements and recommendations in keeping with the essence of the study and definition are technologically acceptable since they are accepted for both the scores obtained on average and the scores obtained from an agreement. The theoretical structure for the study is provided based on the validation of research components and propositions (Table 8).

Table 8
Theoretical framework

Effectiveness Of Entrepreneurship Development	
Startup development	University-based entrepreneurial ecosystem
Identifying competitors Using communication channels Identifying target market Formulation of appropriate strategies User-accepted Technological opportunities and threats Technological needs Institutional support Financing	Strategic practices Capital practices Marketing practices Innovation practices Educational and research practices

Rough analysis

In this step, reference variables are separated from the member variables, the weight of the parameters is calculated, and a visual coding is better understood and deduced (Table 9).

Table 9
Coding of components for rough analysis

Objective	Elements	Research component code
U-BEE components	Strategic practices	Y1
	Capital practices	Y2
	Marketing practices	Y3
	Innovation practices	Y4
	Educational and research practices	Y5
Propositions of technological startup development	Financing	X1
	Institutional support	X2
	Technological needs	X3
	Identifying opportunities and threats	X4
	User-accepted	X5
	Formulation of appropriate strategies	X6
	Identifying the target market	X7
	Using communication and information channels	X8
	Identifying competitors	X9

It is now time to measure the weight of the study parameters with a gray hierarchical review method after making the suggestions and the components of the study. To this end, experts' opinions have been gathered after the comparative matrix for the issue has been established. The next move was to define the degree of incompatibility of each pair matrix. Suppose there is a normal incompatibility in the questionnaire comparison (less than 0.1). In that case, the next move should be taken, or else the questionnaire comparison would be returned to the experts to be tested through pairs. The expert's opinion has been translated to distance numbers after checking the compatibility of the contrast questionnaires in the pair by the Rough theory (Equations 1 to 6). The parameters were eventually obtained, utilizing 8 to 10 weight equations. The result obtained in the gray hierarchical analysis method measurement is seen in Table 10.

Table 10
Results of Gray Hierarchical Analysis Process

Objectives	Criteria weight		Elements	Element weight		Element final weight	
	Lower bound (L)	Upper bound (U)		Lower bound (L)	Upper bound (U)	Lower bound (L)	Upper bound (U)
U-BEE components	0.73	0.86	Strategic practices	0.331	0.382	0.277	0.382
			Capital practices	0.209	0.302	0.192	0.302
			Marketing practices	0.356	0.501	0.288	0.499
			Innovation practices	0.340	0.418	0.298	0.418
			Educational and research practices	0.161	0.280	0.144	0.280
Propositions of technological startup development	0.61	0.70	Financing	0.139	0.289	0.110	0.290
			Institutional support	0.479	0.619	0.414	0.619
			Technological needs	0.127	0.199	0.101	0.20
			Identifying opportunities and threats	0.577	0.893	0.403	0.893
			User-accepted	0.349	0.622	0.305	0.622
			Formulation of appropriate strategies	0.551	0.884	0.522	0.884
			Identifying target market	0.453	0.668	0.404	0.668
			Using communication and information channels	0.156	0.229	0.119	0.224
			Identifying competitors	0.718	0.935	0.679	0.935

The incompatibility values are calculated under 0.1 according to each variable's final weight and proposition, based on which the second part of a rough analysis can be input. The next step is to construct a dilemma decision matrix after measuring the weight of the analysis parameters. To create a matrix for distance decisions, experts were firstly collected using the VIKOR questionnaire.

A decision matrix is developed to evaluate the issue after the experts' views have been circulated and evaluated regarding each alternative's status. For a problem-solving table, the quantitative analysis should be translated into distance numbers for the views of 20 administrators and leaders at various levels of universities in the Golestan province as members of the target population. Equations 1 to 6 are used to translate score analysis to distance numbers.

The presence of technological needs is the most important proposition for developing technology startups, which must be considered following total U-BEEs, based on the effects of the distance decision matrix. Another important proposition for the growth of technology startups was formulating effective techniques. Then analysis options are investigated and analyzed to test VIKOR Grey. After creating a Decision Matrix in the VIKOR Gray process, the first step is to recognize each criterion of the Decision Matrix values for the positive (X) and negative (Y).

None of the solutions have a greater negative ideal, as can be shown, than the positive ideal, and this illustrates the usefulness of any proposition in terms of technology startup growth. However, based on the findings, there was evidence that there is a greater degree of desirability

of technological needs and implementation of suitable strategies than other propositions, suggesting the need to analyze technological needs and implement suitable startup strategies, factor in development, and performance. It is considered a startup firm at the dynamic industry stage. However, the ultimate step in recognizing the key framework for creating startups within the university of an entrepreneurship ecosystem must be the VIKOR Gray approach. This implies that propositions A, B, C, and D are first determined based on equations (16) to (19), and the propositions are then defined using VIKOR Gray's principal proposition, that is, Q, based on equations (20) and (21).

As Proposition Q constitutes the key rule of rough analysis, namely the major feature in changing or strengthening propositions, it was decided in this study that Q was connected to capital functions based on Table (14). However, if the lowest Q value in accordance with the Rough Analysis Guidelines specifies the proposition of the middle, known as the Inverse Rough Analysis, the least significant role for growth in the university entrepreneurship ecosystem was established: education and study role. It is known as a startup technology. The value of the entrepreneurial ecosystem functions at the university level is also second to creative functions. The findings show that the key E-BEE mechanism is developing technology startups, enhancing educational functions, and recognizing research needs. It is at the market level technologically and formulates suitable strategies in this area.

Discussion

A university sub-discipline has begun to gain momentum within the entrepreneurial ecosystem research (Guerrero, Urbano, Fayolle, Klofsten & Mian, 2016). A more fluid connection between university innovators and communities is increasingly critical for driving university entrepreneurship and commercialization (Belitski & Heron, 2017) and economic development. These connections are mechanisms for bringing commercialization knowledge to early-stage academic research and the faculty and students who pursue such research. The research aims to establish technological startups based on university entrepreneurship ecosystems, based on roughly established theories. This target should be meta-combined to define technology startups' technologies and business ecosystems' components at the university level. Accordingly, 57 tentative studies had been reported, and the panel members were interested in picking the most important studies. Sixteen studies were then accepted from 57 studies initially reported. The material review was then conducted using the critical appraisal approach to classify the growth ideas at the university level for startups and the components of a business ecosystem. Delphi then evaluated components and ideas for theoretical adequacy, which validated all the components and recommendations in the findings of this section. The findings in the Rough Set review revealed that among the nine propositions for the development of technology startups are the two most important propositions for technological startups: technological requirements and the formulation of effective strategies.

In other words, entrepreneurs must first determine the industry's technological needs and establish the most realistic kind of company focused on recognizing technological needs through good strategies. These results illustrate a desire for IT entrepreneurs to know more about their target community's technology needs than anything else to grow their startup sector. To consider the issue, entrepreneurs are trying to tackle in the context of technology startups. To determine the need, entrepreneurs need to produce the required evidence on social approaches and gather ecological knowledge to fulfill technological criteria based on a codified plan in this area. However, the most successful role of the University as an entrepreneurial

ecosystem was decided by VIKOR Gray's study to improve the educational and research purpose. This suggests that the University must steer the teaching and advancement of scientific science toward entrepreneurship in the form of an entrepreneurial agenda announced by the Vice President for Technology and Information and transform the University into a forum to create and flourish entrepreneurial ideas in the form of startups. In other words, the university will effectively create awareness and growth of entrepreneurial capacities and skills and contribute to startups, at least in information growth. This outcome shows that educational roles and analysis should be placed on the agenda to establish entrepreneurial approaches, particularly in higher education, due to its definite essence and ideologies. The theory of entrepreneurship ecosystems at the university level boosts student awareness in an unbalanced economic climate as an entrepreneur. Even if the growth of the University over the last few years has contributed to an improvement in the poor standard of education and the content of curricula is mostly theoretical, focusing on the educational and research roles of startup creation will contribute to greater capacity in this sector and improve the productivity of the University for entrepreneurs. It was also observed that the university could develop creative ecosystem functions for technology startups. The university can improve its education services to foster innovation by understanding the technological and knowledge demands at the community level, thereby making them more dynamic. The findings obtained by the researchers kim et al. (2020), Elia et al. (2020), Ali et al. (2019), Thomsen et al. (2018), Nasrollahi et al. (2019), and Kord Heydari Mansouri Moayyed & Khodadad Hoseini (2019) correlate in this report, taking into account the extraction of related studies.

Conclusion

Accordingly, similar to the results achieved, it is proposed that the university first define the extent of social, fiscal, commercial, and business requirements in the form of specialist teams in a variety of fields and then plan and join the business by training and training entrepreneurs. Besides, as an ecosystem base, the universities should sustain long-term connections with startup companies and invest in strategies, ventures, and motivations for self-employed companies, which will be of value to the future in this field. It also proposed that the extent of university ties with industry and other regulatory bodies in the fields of entrepreneurship and IT should be improved in the long term and that the growth of entrepreneurship is increasingly possible through the organization of conferences and exhibitions, goods and services in the way of startups from the university document.

References

Abou-Warda, S.H. (2016). New educational services development: Framework for technology entrepreneurship education at universities in Egypt. *International Journal of Educational Management*, 30(5), 698-717. https://doi.org/10.1108/IJEM-11-2014-0142

Agarwal, R., Audretsch, D. & Sarkar, M.B. (2010). Knowledge spillovers and strategic entrepreneurship. *Strategic Entrepreneurship Journal*, 4(4), 271-283. https://doi.org/10.1002/sej.96

Ali, I., Ali, M. & Badghish, S. (2019). Symmetric and asymmetric modeling of entrepreneurial ecosystem in developing entrepreneurial intentions among female university students in Saudi Arabia, *International Journal of Gender and Entrepreneurship*, 11(4), 435-458. https://doi.org/10.1108/IJGE-02-2019-0039

Bandarian, R. (2018). Explaining the reasons for emerging tech startups in the upstream oil industry and their specific challenges. *Journal of Science and Technology Policy Letters*, 8(3), 7-20. [in Persian]

Baradaran, M.S., Yadollahi Farsi, J., Hejazi, S.R. & Akbari, M. (2020). Competence at technology entrepreneurship: An interpretive view, *Journal of Economic and Administrative Sciences*, 38(1), 1-17. https://doi.org/10.1108/JEAS-08-2018-0095

Bask, A.H., Tinnilä, M. and Rajahonka, M. (2010). Matching service strategies, business models and modular business processes. *Business Process Management Journal*, 16(1), 153-180. https://doi.org/10.1108/14637151011017994

Belitski, M. & Heron, K. (2017). Expanding entrepreneurship education ecosystems. *Journal of Management Development*, 36(2), 163-177. http://doi.org/10.1108/JMD-06-2016-0121

Berger, E. & Kuckertz, A. (2016). Female entrepreneurship in startup ecosystems worldwide. *Journal of Business Research*, 69(11), 7102-7102. https://doi.org/10.1016/j.jbusres.2016.04.098

Bird, B. (1995). Toward a Theory of Entrepreneurial Competency. In J.A.Katz & R.H.Brockhaus, Sr.(Eds), *Advances in Entrepreneurship, Firm Emergence, and Growth*. 2,51-72. Greenwich, CN: JAI Press

Bloom, P.N. & Dees, J. G. (2008). Cultivate your ecosystem. *Stanford Social Innovation Review*, 6(1), 47-53. https://doi.org/10.48558/QWAW-VP62

Ceballos, R., Hou, W., Levitas, E. & Price, S.M. (2017). The product, the mind and the heart of crowdfunding: The effect of signals on technology projects. *International Journal of Services and Standards*, 12(1), 79-99.

Dushnitsky, G. & Lenox, M. J. (2005). When do incumbents learn from entrepreneurial ventures?: Corporate venture capital and investing firm innovation rates. *Research Policy*, 34(5), 615-639. https://doi.org/10.1016/j.respol.2005.01.017

Elia, G., Margherita, A. & Passiante, G. (2020). Digital entrepreneurship ecosystem: How digital technologies and collective intelligence are reshaping the entrepreneurial process. *Technological Forecasting and Social Change*, 150(3), 119-141. https://doi.org/10.1016/j.techfore.2019.119791

Entezari Y. (2019). Development requirements of university-based entrepreneurship ecosystems in Iran. *Iranian Research and Planning in Higher Education*, 25(1), 1-25. [in Persian]

Entezari, Y. (2015). Building knowledge-based entrepreneurship ecosystems: Case of Iran. *Procedia-social and behavioral sciences*, 195, 1206-1215. https://doi.org/10.1016/j.sbspro.2015.06.242

Etzkowitz, H. (1983). Entrepreneurial scientists and entrepreneurial universities in American academic science. *Minerva*, 21(2-3), 198-233. https://doi.org/10.1007/BF01097964

Feld, B. (2012). Startup communities: Building an entrepreneurial ecosystem in your city. 2nd Edition, John Wiley & Sons.

Fernandez, M, T., Jimenez, J, B. & Roura, J, R. (2015). Business incubation: innovative services in an entrepreneurship ecosystem, *The Service Industries Journal*, 35(14), 783-800. https://doi.org/10.1080/02642069.2015.1080243

Gnyawali, D. R. & Fogel, D. S. (1994). Environments for entrepreneurship development: key dimensions and research implications. *Entrepreneurship theory and practice*, 18(4), 43-62. https://doi.org/10.1177%2F104225879401800403

Guerrero, M., Urbano, D., Fayolle, A., Klofsten, M. & Mian, S. (2016). Entrepreneurial universities: Emerging models in the new social and economic landscape. *Small Business Economics*, 47(3), 551-563. http://doi.org/10.1007/s11187-016-9755-4

Huang-Saad, A., Duval-Couetil, N. & Park, J. (2018). Technology and talent: capturing the role of universities in regional entrepreneurial ecosystems. *Journal of Enterprising Communities: People and Places in the Global Economy*, 12(2), 92-116. https://doi.org/10.1108/JEC-08-2017-0070

Isenberg, D. J. (2010). How to start an entrepreneurial revolution. *Harvard business review*, 88(6), 40-50.

Kang, Q., Li, H., Cheng, Y. & Kraus, S. (2021). Entrepreneurial ecosystems: Analysing the status quo. *Knowledge Management Research and Practice*, 19(1), 8-20. https://doi.org/10.1080/14778238.2019.1701964

Kim, H, J., Kim, T, S. & Sohn, S, Y. (2020). Recommendation of startups as technology cooperation candidates from the perspectives of similarity and potential: A deep learning approach. *Decision Support Systems*, 130(3), 113139. https://doi.org/10.1016/j.dss.2019.113229

Kordheydari, R., Mansouri Moayyed, F.& Khodadad Hoseini, H. (2019). Metasynthesis of factors affecting to develop startups in new technology-based firms in entrepreneurial ecosystem. *Journal of Entrepreneurship Development*, 12(1), 141-160. https://dx.doi.org/10.22059/jed.2019.279279.652965 [in Persian]

Lamine, W., Mian, S., Fayolle, A., Wright, M., Klofsten, M. & Etzkowitz, H. (2018). Technology business incubation mechanisms and sustainable regional development. *Journal of Technology Transfer*, 43(5),1121-1141. https://doi.org/10.1007/s10961-016-9537-9

Liao, Y.C. & Phan, P.H. (2016). Internal capabilities, external structural holes network positions, and knowledge creation. *The Journal of Technology Transfer*, 41(5), 1148-1167. https://doi.org/10.1007/s10961-015-9415-x

Maritz, A., Nguyen, Q.A., Shrivastava, A. & Ivanov, S. (2022). University accelerators and entrepreneurship education in Australia: substantive and symbolic motives. *Education + Training*, [in print]. https://doi.org/10.1108/ET-08-2021-0325

Maroufkhani, P., Wagner, R. & Wan Ismail, K.W. (2018). Entrepreneurial ecosystems: A systematic review. *Journal of Enterprising Communities: People and Places in the Global Economy*, 12(4), 545-564. https://doi.org/10.1108/JEC-03-2017-0025

Marvel, M.R. & Droege, S. (2010). Prior tacit knowledge and first-year sales: learning from technology entrepreneurs, *Journal of Small Business and Enterprise Development*, 17(1), 32-44. https://doi.org/10.1108/14626001011019116

Maysami, A., Mohammadi Elyasi, G., Mobini Dehkordi, A. & Hejazi, S. (2018). The Dimensions and Components of Technological Entrepreneurship Ecosystem in Iran. *Journal of Technology Development Management*, 5(4), 9-42. [in Persian].

McHenry, J. (2008). The role and management of learning from experience in an entrepreneurial context. In Richard T. Harrison, Claire M. Leitch (Eds) *Entrepreneurial Learning: Conceptual Frameworks and Applications*, Routledge, London, 72-91.

McKeon, T, K. (2013). A college's role in developing and supporting an entrepreneurship ecosystem. *Journal of Higher Education Outreach and Engagement*, 17(3), 85-89. Retrieved from https://community-wealth.org/sites/clone.community-wealth.org/files/downloads/article-mckeon.pdf

Moore, J. F. (1993). Predators and Prey: A New Ecology of Competition. *Harvard Business Review*, 71(3), 75-86.

Morris, M.H., Webb, J.W., Fu, J. & Singhal, S. (2013). A competency-based perspective on entrepreneurship education: Conceptual and empirical insights. *Journal of Small Business Management*, 51(3), 352-369. https://doi.org/10.1111/jsbm.12023

Nasrollahi, M., Fathi, M. & Shoshpari, F. (2019). Study of effective factors on the selection of collaboration strategy among (institutionalized companies) and startups (Case study: startups of Qazvin Science and Technology Park). *Quarterley Journal of Industrial Technology development*, 17(35): 63-72. [in Persian]

Neck, H. M., Meyer, G. D., Cohen, B. & Corbett, A. C. (2004). An Entrepreneurial System View of New Venture Creation. *Journal of Small Business Management*, 42(2), 190–208. https://doi.org/10.1111/j.1540-627X.2004.00105.x

Oliva, F, L. & Kotabe, M. (2019). Barriers, practices, methods and knowledge management tools in startups. *Journal of Knowledge Management*, 23 (9), 1838-1856. https://doi.org/10.1108/JKM-06-2018-0361

Padilla-Meléndez, A., Fuster, E., Lockett, N., & del-Aguila-Obra, A. R. (2021). Knowledge spillovers, knowledge filters and entrepreneurial university ecosystems: Emerging role of University-focused venture capital firms. *Knowledge Management Research & Practice*, 19(1), 94-105. https://doi.org/10.1080/14778238.2020.1740626

Park, Y, J. & Park, Y, W. (2018). Spinoffs versus non-spinoff entrepreneurs: Exploring post-bubble Japan's entrepreneurial ecosystem. *Asia Pacific Journal of Innovation and Entrepreneurship*, 12(2), 146-164. https://doi.org/10.1108/APJIE-04-2018-0020

Pattnaik, P, N. & Pandey, S, C. (2017). University startups and special legislations: Genesis and developments in the United States of America, Japan and India. *International Journal of Law and Management*, 59(5), 718-728. https://doi.org/10.1108/IJLMA-05-2016-0046

Pawlak, Z. (2005, August). Rough sets and flow graphs. In *International Workshop on Rough Sets, Fuzzy Sets, Data Mining, and Granular-Soft Computing* (pp. 1-11). Springer, Berlin, Heidelberg.

Pool, S. & Van Itallie, M. (2013). Learning from Boston: Implications for Baltimore from comparing the entrepreneurial ecosystems of Baltimore and Boston. Boston: Abell Foundation. Retrieved from https://abell.org/sites/default/files/publications/CD-BaltoBostonEntreEcosys813.pdf

Rice, M.P., Fetters, M.L. & Greene, P.G. (2014) University-based entrepreneurship ecosystems: a global study of six global institutions. *International Journal of Entrepreneurship and Innovation Management*, 18(5/6), 481–501.

Sadeghi-Fasaei, S. & Naseri-Rad, M. (2012). Fundamental elements to of qualitative research in social sciences (ontology, epistemology, methodology and methods). *Journal of Iranian Social Studies*, 5(2), 78-98. [in Persian]

Sanchez, A.M. & Perez, O.U. (1998). Entrepreneurship networks and high technology firms: The case of Aragon.*Technovation*, 18(5), 335-345.

Sandelowski, M. & Barroso, J. (2008). Handbook for synthesizing qualitative research. NewYork: Springer.

Shahrabi, B., Ashrafi, M., & abbasi, E. (2019). Modeling Factors Affecting Startups Financing Using DEMATEL Technique. *Financial Management Strategy*, 7(2), 61-89. https://dx.doi.org/10.22051/jfm.2019.21525.1753 [in Persian]

Shyng J, Y., Tzeng G, H., Wang F, K. (2007). Rough set theory in analyzing the attributes of combination values for insurance market, Expert System with Applications, 32, 56-64. https://doi.org/10.1016/j.eswa.2005.11.002

Spender, J, C., Corvello, V., Grimaldi, M. and Rippa, P. (2017). Startups and open innovation: A review of the literature, European Journal of Innovation Management, 20(1): 4-30. https://doi.org/10.1108/EJIM-12-2015-0131

Spigel, B. (2015). The relational organization of entrepreneurial ecosystems. *Entrepreneurship: Theory & Practice*, 41(1), 49-27. https://doi.org/10.1111%2Fetap.12167

Stam, E. (2015) Entrepreneurial Ecosystems and Regional Policy: A Sympathetic Critique. *European Planning Studies*, 23(9), 1759-1769. http://dx.doi.org/10.1080/09654313.2015.1061484

Stam, E. & van de Ven, A. (2021). Entrepreneurial ecosystem elements. *Small Business Economics*, 56(2), 809-832. https://doi.org/10.1007/s11187-019-00270-6

Stirling, J., (2001). Thematic networks: An analytic tool for qualitative research, Qualitative research, 1(3), 385-405. https://doi.org/10.1177%2F146879410100100307

Thomsen, B., Muurlink, O. & Best, T. (2018). The political ecology of university-based social entrepreneurship ecosystems. *Journal of Enterprising Communities: People and Places in the Global Economy*, 12(2), 199-219. https://doi.org/10.1108/JEC-08-2017-0068

Tripathi, N., Ovivo, M., Liukkunen, K. & Markkula, J. (2019). Startup ecosystem effect on minimum viable product development in software startups. *Information and Software Technology*, 114(2), 77-91. https://doi.org/10.1016/j.infsof.2019.06.008

Valdez, J. (1988). The entrepreneurial ecosystem: toward a theory of new business formation. *Proceedings of the Small Business Institute Director's Association, Jude, University of Texas, San Antonio*. (pp. 102-119). Retrieved from: http://sbida.org/Resources/Documents/Proceedings/1988%20Proceedings

Valdez, M. E. & Richardson, J. (2013). Institutional determinants of macro - level entrepreneurship. *Entrepreneurship Theory and Practice*, 37(5), 1149-1175. https://doi.org/10.1111%2Fetap.12000

Wright, M., Hmieleski, K.M., Siegel, D.S. & Ensley, M.D. (2007). The role of human capital in technological entrepreneurship. *Entrepreneurship Theory and Practice*, 31(6), 791-806. https://doi.org/10.1111%2Fj.1540-6520.2007.00202.x

Wurth, B., Stam, E. & Spigel, B. (2021). Toward an entrepreneurial ecosystem research program. *Entrepreneurship Theory and Practice*, 1-50. https://doi.org/10.1177%2F1042258721998948

Xu, B., Zhang, Sh., Chen, X. (2020). Uncertainty in financing interest rates for startups. *Industrial Marketing Management*, 94, 150-158. https://doi.org/10.1016/j.indmarman.2020.02.026

Yáñez-Valdés, C. (2021). Technological entrepreneurship: Present conditions and future perspectives for Latin America. *Management Research*, (vol. ahead-of-print no. ahead-of-print) https://doi.org/10.1108/MRJIAM-09-2021-1230

Yang, J., Liu, Y., Zhang, Y., Chen, H. & Niu, F. (2015). Escalation bias among technology entrepreneurs: the moderating effects of motivation and mental budgeting, *Technology Analysis and Strategic Management*, 27(6), 693-708. https://doi.org/10.1080/09537325.2015.1034674

Zhang, Q., Xie, Q. & Wang, G. (2016). A survey on rough set theory and its applications. *CAAI Transactions on Intelligence Technology*, 1(4), 323-333. https://doi.org/10.1016/j.trit.2016.11.001