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Presenting the evolutionary model of Iran's startup ecosystem

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Abstract

Today, maintaining the competitiveness of innovation and economic growth and development by strengthening and promoting entrepreneurship is one of the most important economic concerns of the leaders of countries worldwide. The requirement for the development of productive entrepreneurship is to create an entrepreneurial ecosystem that provides smooth and favourable conditions for the growth and flourishing of entrepreneurial activities of high-growth companies and creative and innovative startups. In this research, an attempt has been made to present the evolutionary model of Iran's startup ecosystem. In the current research, 2 ecosystems have been studied and investigated. The method of collecting information is library-based and based on the official statistics of the Global Entrepreneurship Development Institute and the official website of the World Bank and FAVA (Iranian Technology and Information Organization), GNOME Institute, the Central Bank and the Department of Statistics and Information of Iran. This article has three phases. The first phase is to determine the components and factors that define the startup ecosystem, and the relationship between them is also examined. The map produced in phase one and the presentation of the maturity model for the evolution process of the ecosystem under it. In this phase, the mixed method of literature review and a panel of experts has been used. The third phase aims to refine and validate the evolutionary and maturity model presented in the second phase. Following the necessity of adopting a comprehensive approach to the category of promoting and supporting productive entrepreneurship which leads in the current research, the elements are explained and the nature of the startup ecosystem is taken into consideration, and according to the nature of the startup ecosystem and the need to create systemic changes And comprehensively, in this approach in three phases and case research in three regions, we achieved a mature and evolved model in Iran's startup ecosystem.

Keywords: startup ecosystem, entrepreneurship, evolutionary model, economic growth
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1 Introduction

The concept of business ecosystem was first used by Moore in 1993. He aimed to describe economic societies and create innovative value through a new perspective. According to Moore, the actors in the ecosystem are firms or

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companies that directly create value. They are jointly involved and the beneficiaries are governments and legislators [18]. Development and growth have always been the main axis of the policies and programs of different countries, and the two important paths to pursue have been to provide optimal conditions for entrepreneurship and also the development of technology [12].

Although the pursuit of these two categories (entrepreneurship and technology) is important in itself, the combination of the two, which is known as technological entrepreneurship, has had the greatest impact on development, competitiveness, prosperity, progress and even justice in different societies. Undoubtedly, the emergence of technological entrepreneurship depends on the existence of favourable conditions and a suitable context, which is necessary to identify and explain it according to specific national or regional characteristics.

Today, due to the rapid increase in competition and the complications of the information age, organizations need to learn skills that can progress with modern science. One of these important and effective skills is creativity, innovation and entrepreneurship, which everyone can use to try to grow and develop their company or organization. Therefore, if a person in the organization has the highest level of skill but does not benefit from creativity and innovation skills, he will never be able to do creative work and move in the direction of growth. The necessity of creativity in the present era is due to: the need for the economic growth of countries, the need to increase productivity, create new technologies, competition, survival, create goods and services, increase income, and social welfare. Entrepreneurship is a process in which innovative and appropriate ideas are identified and implemented in order to take advantage of existing opportunities and resources. One of the most important factors for strengthening and expanding the culture of innovation, creativity and entrepreneurship is the existence of appropriate organizational structures and organizations. Sports startups grow, improve and support the innovative efforts of entrepreneurs to provide new products and services and provide the platform for this dynamic. In this research, an effort was made to identify the basics of innovation, creativity and entrepreneurship, the factors affecting them and the ability of innovation and entrepreneurship in the sports startups of North Khorasan province with the analysis The gap between the desired level and the existing situation is an opportunity for rapid growth. And the organized organization provides innovation in order to present ideas to the market in the company in order to be able to provide resistance in sports startups with jihadi management in the implementation of the economy to overcome the crisis of economic sanctions and stagnation. According to the researchers, innovation and creativity is the necessary platforms for the implementation of the resistance economy and the dynamism of sports startups in order to gain technical knowledge and sustainable production technology. The results obtained from this research show that in the last few years, the trend of improving the innovation capacity of sports startups has decreased and the level of organizational innovation is not effective, and it is necessary to change the existing organizational structure of sports startups. Especially in the research and development and changes department, It has made the culture and attitudes of managers necessary to move towards organic structures. In these structures, organizational innovation, creativity and entrepreneurship provide a more suitable adaptation to the changing environmental conditions and the possibility of flexibility and freedom of action for the employees of sports startup units, which is a very suitable platform for creating innovation. will provide organizational creativity and entrepreneurship in the group of sports startups [13].

The country of Iran with special features such as huge natural resources, young and educated human capital and a semi-state economic structure that is trying to achieve efficiency-oriented growth [20] in general with relative backwardness in the conditions of entrepreneurial lands and Technology and more specifically and more intensively in the state of technological entrepreneurship has been faced as an important path to achieve internal growth and development. Among the significant problems and weaknesses in this regard, there is a strong weakness in the policies and operational plans of the government, underdeveloped commercial and legal infrastructure, and insufficient funding (World Entrepreneurship Research Association 8, 2016) as well as weakness in innovation indicators [8] and technological readiness [20]. Such conditions have resulted in the need for comprehensive and appropriate attention to the context and environment of entrepreneurship and technology in the country, which has been seriously emphasized in the top documents of the system such as science and technology policies as well as resistance economy.

In this regard, one of the important paths that require attention and action regarding the emergence and growth of technological entrepreneurship in the country is aimed at adopting an ecosystem approach, which means considering the interactive system between entities and their environment [19]. Although this approach in the field of technological entrepreneurship has not been carefully conceptualized in the direction of the evolution and maturity of the existing ecosystem, however, attention to other related fields, including the entrepreneurial ecosystem (such as the framework of Isenberg [11] and Ahmad, Hoffman [2], the innovation ecosystem (such as Grote et al.'s research [9] and technological entrepreneurship models (such as Petti, Zhang [15] and Prodan [16]) can be an important basis for Understanding, understanding and evolutionary structuring of this ecosystem should be considered in order to have a favourable effect on development and improvement strategies, policies and programs.

Studies show that entrepreneurial ecosystems have rapidly become a common tool in studying the geography of entrepreneurship. Ecosystems are a set of concentrated cultural perspectives, social networks, financial support, universities and active economic policies that support entrepreneurial environments. and creates risky work based on innovation [18].

Entrepreneurs in the ecosystem must be able to recognize and exploit opportunities not only in the ecosystem but also outside it.

In this way, by studying the successful startup ecosystem of Silicon Valley and recognizing its opportunities, threats, strengths and weaknesses, and further by studying and analyzing Iran's startup ecosystem more deeply, we aim to take a role model and find points that can be refined and improved in the existing ecosystem in Iran. Let's get an evolutionary model.

2 Background research

The Lean Startup methodology teaches you how to lead a startup when to change it, and what ways to grow it. Lean Startup gives you a scientific approach to building and managing a startup and helps you get your product to customers faster. Many startups are launched with the idea of making a product that people need. They spend months and even years perfecting their product without showing it to the customer. This is what causes many of them to fail. Because they don't talk to customers and get feedback about their products. When customers can't connect with a startup, they don't care about its idea, and as a result, the startup fails. According to the FAVA report in 2015, the internal obstacles to the success of Iranian startups have been examined more precisely and compared with the internal obstacles of startups in other countries. Attempts have been made to examine the solutions of different countries to eliminate these obstacles. These obstacles include low liquidity, inappropriate strategy in dealing with competitors, inappropriate business models, weak products, weak management team and lack of attention to customer needs.

The innovation ecosystem includes a group of local factors and dynamic processes that interact with each other in facing and solving complex challenges; This ecosystem is a dynamic and interactive network that has led to innovative development and can refer to local hubs, global networks and even technology platforms [14].

In their book, Hwang, and Horowitt [10] have introduced a special approach called tropical forests in the field of the innovation ecosystem, which consists of two groups of hard factors (people, experts, infrastructure and politics) and soft factors (diversity, meta-rational motives, trust). social, tropical forest rules and interpretation of rules) is formed.

Durst and Poutanen [6] with the aim of explaining the success factors in the implementation of the innovation ecosystem, reviewed and systematically reviewed the texts related to this field and identified 9 main dimensions of resources, governance, strategy and leadership, organizational culture, human resource management, people, technology, partners and clustering from their analysis, according to which the dimension of governance received the most importance, and after that, strategy and leadership, culture and partners were introduced as the main effective factors in the success of the innovation ecosystem, which are closely related They are also with the dimension of governance. Finally, Rabelo and Bernus [17] in their article comprehensively reviewed the literature of 9 specific dimensions including actors (government, universities, industry, support institutions, entrepreneurs, financial system, customers and individuals), capital, infrastructure, rules, knowledge, and ideas have identified the communication channel, culture and structural principles as factors that affect the creation and evolutionary development of innovation ecosystems.

Technological entrepreneurship has been conceptually expanded and developed to such an extent since the topic was proposed in the academic literature, which was linked to the 1970 entrepreneurship conference at Purdue University in the United States, that it is necessary to adopt a comprehensive and holistic approach. Regarding the study and review, its results. In one of the comprehensive definitions, Byers et al. [4] have introduced technological entrepreneurship as the creation of new companies to exploit technological innovations, which includes identifying attractive and commercialized technological opportunities, gathering resources, managing rapid growth, and managing risk. be made

3 Research method

In the current situation, successful technology startups have become the growth engine of the information economy and the Internet economy, and the recent development of startup ecosystems around the world will have significant

results in the future of the global economy. On the other hand, due to the population peak reaching the effective age and the need for employment, entrepreneurship and job creation are considered one of the important concerns of the society. The government's programs for creating jobs and providing loans to small businesses and home businesses, as well as the activities of the private sector in order to attract and cultivate new ideas and turn them into start-up businesses, are very important in the economic development of the country, events such as Startup Weekend and the creation of growth centers. and academic jihads in different universities have created this opportunity for young entrepreneurs to implement their ideas, despite these activities in the field of entrepreneurship and support for startups, Iran is still considered a young country in this field and still has to create Suitable platforms have a long way to go. The current research has three phases. The first phase is to determine the components and factors that define the startup ecosystem, and the relationship between them is also examined. The map produced in phase one and the presentation of the maturity model for the evolution process of the ecosystem under it. In this phase, the mixed method of literature review and a panel of experts has been used.

The third phase aims to refine and validate the evolutionary and maturity model presented in the second phase. This phase completes the last phase of our multiple research cases. Designing a multiple research model for the analysis of complex research entities is the richness and reliability of the models. These cases are about our startup ecosystem (Iran) and multiple cases of research goals.

Thus, in this research, a case study has been conducted in three ecosystems of Brazil, Iran, and New York, and instead of mapping the characteristics of the innovation ecosystem and introducing the actions and policies of those places [7], the principles of this research are based on the goal that the dynamics and Understand how they evolve over time.

Therefore, in this research, a multiple case study was carried out on Brazil, Iran, and Silicon Valley, and instead of mapping the characteristics of the innovation ecosystem and introducing the measures and policies of those places [7], the principles of this research are based on the goal that the dynamics and how they evolve To understand over time.

It is important to understand the characteristics of each ecosystem as a big picture at a time, but the evolution of their dynamics allows us to understand the path of ecosystem growth in a sustainable way. By drawing a road map, we can show the beneficiaries the next step needed to progress in the path of evolution.

The method of collecting information is library-based and based on the official statistics of the Global Entrepreneurship Development Institute and the official website of the World Bank and FAVA (Iranian Technology and Information Organization), GNOME Institute, the Central Bank and the Department of Statistics and Information of Iran.

3.1 The linear panel model

The basic linear panel models used in econometrics can be described through suitable restrictions of the following general model:

$$y_{it} = \alpha_{it} + \beta_{it}^T x_{it} + u_{it}$$

where $i = 1, \cdots, n$ is the individual (group, country ...) index, $t = 1, \cdots, T$ is the time index and u_{it} a random disturbance term of mean 0.

Of course u_{it} is not estimable with $N = n \times T$ data points. A number of assumptions are usually made about the parameters, the errors and the exogeneity of the regressors, giving rise to a taxonomy of feasible models for panel data. The most common one is parameter homogeneity, which means that $\alpha_{it} = \alpha$ for all i,t and $\beta_{it} = \beta$ for all i,t. The resulting model

$$y_{it} = \alpha + \beta^T x_{it} + u_{it}$$

is a standard linear model pooling all the data across i and t. To model individual heterogeneity, one often assumes that the error term has two separate components, one of which is specific to the individual and doesn't change over time. This is called the unobserved effects model:

$$(\#eq : errcomp)\ y_{it} = \alpha + \beta^T x_{it} + \mu_i + \epsilon_{it}.$$

The appropriate estimation method for this model depends on the properties of the two error components. The idiosyncratic error ϵ_{it} is usually assumed well-behaved and independent of both the regressors xit and the individual error component μ_i. The individual component may be in turn either independent of the regressors or correlated. If it is correlated, the ordinary least squares (OLS) estimator of β would be inconsistent, so it is customary to treat the μ_i as a further set of n parameters to be estimated as if in the general model $\alpha_{it} = \alpha_i$ for all t. This is called the fixed

effects (*a.k.a. within or least squares dummy variables*) model, usually estimated by OLS on transformed data, and gives consistent estimates for β.

If the individual-specific component μ_i is uncorrelated with the regressors, a situation which is usually termed *random effects*, the overall error u_{it} also is, so the OLS estimator is consistent. Nevertheless, the common error component over individuals induces correlation across the composite error terms, making OLS estimation inefficient, so one has to resort to some form of feasible generalized least squares (GLS) estimators. This is based on the estimation of the variance of the two error components, for which there are a number of different procedures available.

If the individual component is missing altogether, pooled OLS is the most efficient estimator for β. This set of assumptions is usually labelled *pooling* model, although this actually refers to the errors' properties and the appropriate estimation method rather than the model itself. If one relaxes the usual hypotheses of well-behaved, white noise errors and allows for the idiosyncratic error ϵ_{it} to be arbitrarily heteroskedastic and serially correlated over time, a more general kind of feasible GLS is needed, called the *unrestricted* or *general* GLS. This specification can also be augmented with individual-specific error components possibly correlated with the regressors, in which case it is termed *fixed effects* GLS.

Another way of estimating unobserved effects models through removing time-invariant individual components is by first-inferencing the data: lagging the model and subtracting, the time-invariant components (the intercept and the individual error component) are eliminated, and the model

$$\Delta y_{it} = \beta^T \Delta x_{it} + \Delta u_{it}$$

where $\Delta y_{it} = y_{it} - y_{i,t} - 1\Delta - 1$, $\Delta x_{it} = x_{it} - x_{i,t} - 1\Delta - 1$ and from, $\Delta u_{it} = u_{it} - u_{i,t} - 1 = \Delta\epsilon_{it}\Delta - 1 = \Delta$ for $t = 2, \cdots, T = 2, \cdots$, can be consistently estimated by pooled OLS. This is called the *first-difference* or FD estimator. Its relative efficiency, and so reasons for choosing it against other consistent alternatives, depends on the properties of the error term. The FD estimator is usually preferred if the errors u_{it} are strongly persistent in time, because then the $\Delta u_{it}\Delta$ will tend to be serially uncorrelated.

Lastly, the *between* model, which is computed on time (group) averages of the data, discards all the information due to intragroup variability but is consistent in some settings (e.g., non-stationarity) where the others are not, and is often preferred to estimate long-run relationships.

Variable coefficients models relax the assumption that $\beta_{it} = \beta$ for all i, t. Fixed coefficients models allow the coefficients to vary along one dimension, like $\beta_{it} = \beta_i$ for all t. Random coefficients models instead assume that coefficients vary randomly around a common average, as $\beta_{it} = \beta + \eta_i$ for all t, where η_i is a group– (time–) specific effect with mean zero.

The hypotheses on parameters and error terms (and hence the choice of the most appropriate estimator) are usually tested by means of:

- *pooling* tests to check poolability, i.e., the hypothesis that the same coefficients apply across all individuals,
- if the homogeneity assumption over the coefficients is established, the next step is to establish the presence of unobserved effects, comparing the null of spherical residuals with the alternative of group (time) specific effects in the error term,
- the choice between fixed and random effects specifications is based on Hausman-type tests, comparing the two estimators under the null of no significant difference: if this is not rejected, the more efficient random effects estimator is chosen,
- even after this step, departures of the error structure from sphericity can further affect inference, so that either screening tests or robust diagnostics are needed.

Dynamic models and in general lack of strict exogeneity of the regressors, pose further problems to estimation which are usually dealt with in the generalized method of moments (GMM) framework.

4 Research findings

4.1 The first phase of research

The figure of the model shown below is the initial version of the model that has been improved in phase 2. As long as the model is complex, it is recommended to follow the model without considering the full understanding of

the details during the drawing of the map. In addition, the map clearly shows many elements that play a role in the startup ecosystem, and there are many relationships between them. The relationship between the elements in the map is shown in two ways:

1. The continuous line that shows the main connection and shows that the connection between the elements has been established most of the time.
2. Dashed line which indicates the secondary connection. It indicates that there was a connection at some time. The label of the lines specifies their type of connection.

4.2 Phase two: Perspectives for Iran's ecosystem

After the first research case (Brazilian ecosystem), an extensive literature review was conducted. The sources of the articles include Google Scholar, experts' recommendations for ecosystem research and the snowball method of sources while studying the articles. The key words used are "ecosystem. startup" and "entrepreneurial ecosystem".

After reviewing the literature, the second case has been started and data has been collected from different sources and data analysis has been done based on metacomposite principles and the conceptual model has been improved.

Thus, the purpose of this section is to analyze Iran's startup ecosystem and collect views related to this ecosystem to refine and validate the model of the first part, as well as provide a model for the ecosystem's maturation process. During the study of Iran's ecosystem, many elements of the conceptual model of phase one We confirmed and improved the model. The main changes of this model are:

- Mentoring of entrepreneurs by entrepreneurs
- Media and events were incorporated into society and culture.
- Summarizing the elements of the training section, removing unnecessary details
- Summarize the market segment elements
- Summarizing the elements of the technology sector, removing open source and proprietary details

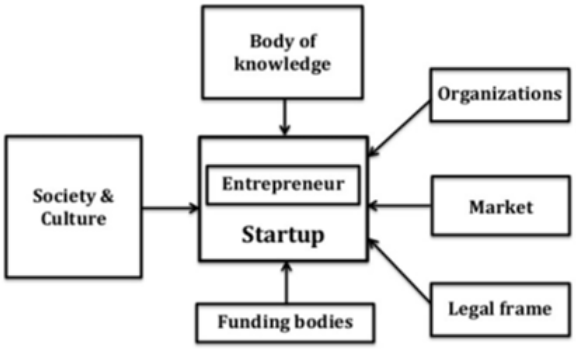

Figure 1: Conceptual framework of startup ecosystem - simplified version

- Summarizing the research methods section, leaving the model incomplete to include every research method.
- The section related to the center of innovation and technology transfer was summarized by the technology park;

According to the main elements of the ecosystem, the first two items in bold letters are the most important findings of this stage. As we will see later in the results of step 3, these two factors (1) media and (2) guiding entrepreneurs (and funding) new entrepreneurs play a very important role in the evolution of ecosystems. Table 1 presents the main elements of the model.

This edition can serve as a guiding light for our work, an easy-to-understand introduction to a more complete framework. Different from step 1, when we used the SWOT analysis method (Strengths, Weaknesses, Opportunities, Threats) to better understand the Brazilian ecosystem and provide more constructive proposals.

Table 1: List of the main elements of the perceptual model of the startup ecosystem

elements	**No.**
startup	1
entrepreneur	2
Family	3
geogeraphical location	4
Demographic	5
Society	6
Culture	7
events	8
Media	9
Education	10
technologists	11
Research methods	12
Universiti/Research Center	13
Technologics parks	14
Growth centers/accelerators	15
Established Companies	16
Market	17
Legal framework	18
Financing institutions	19

5 factor analysis of Iran's innovation ecosystem

5.1 Main inputs suitable for Iran's innovation systems

Table 2 is a list of 14 main supports that experts consider as the pillars of the innovation system [5]. Table 3 is a list of processes that experts consider to be the main elements of creating and promoting innovation. "Lands" are actually similar to what economists call "stocks" or "fixed assets", while processes are similar to what economists call "flows" (changes in various supports, or stocks). The experts ranked the processes based on their importance and categorized them based on the rules of the economic model of supply or demand.

Table 2: List of Iran's innovation pillars

The name of the support	No
Quality human capital	1
Availability of financial facilities	2
Growth centers	3
(lack of) entrepreneurial culture	4
(lack of) integrity throughout Iran's schools and colleges	5
Catching low-risk employment in the company	6
Scientific infrasstructure	7
Powerful faculty with out standing professors	8
organization of entrepreneurial students (Fava)	9
Union oriented attitude	10

The basis of an ecosystem is the interaction between its various components (James F Moore, 1996). Data on "interaction analysis" (observed links between support types and processes) were used to measure the five-point bipolar Likert scale (ranging from strongly negative association with a score of 1 to strongly positive association with a score of 5) for each row in the interaction matrix. "10x14" is drawn).

1= very negative link 2= almost negative link 3= no link 4= almost positive link 5= very positive link

5.2 Startup Ecosystem Growth and Maturity Model: First Edition

The conceptual framework discovered in Phase 1 and modified in Phase 2 included the main elements of any software startup ecosystem. These core elements are not separate features; Rather, they are related to each other in different ways. For each main element, it is possible to analyze not only the level of its development but also the quality of the relationships between them so that the degree of maturity in each dimension can be measured. Examples of maturity measurement criteria in the main elements are financial institutions; the growth level of the financial structure in the ecosystem; The existence of technical ability and talent (talented people) offered by superior educational institutions; and access to educational resources.

Table 3: The list of processes that were collected in order to promote innovation and were classified based on the importance of ranking and according to the rules (supply or demand) of the market.

supply (D) and demand (Supply)	Process name	Ranking by numbers (by importance)
S		1
D,S	Growth/acceleration processes	2
S	Informal networking, entrepreneurship support activities	3
D,S	Initial capital and venture capital	4
D,S	Graduates share their biographies and duties	5
D	Cooperation with government and industry	6
D	Talent database	7
D,S	Scattered information, (was not), lack of process of using one place to provide multiple services	8
D,S	Technology transfer process	9
D	Guidance and guidance	10

Table 4: Classification of ecosystem maturity factor version 1 [5]

L3	L2	L1	Factor
$>50\%$	10-50%	$<10\%$	Global Market
$\geq 50\%$	10-50%	$<10\%$	Military impact on technologies
$>10\%$	2-10%	$<2\%$	Entrepreneurship in universities
$> K3$	K3-500	<500	Number of startups
$> B1$	B1- M200	M200	Access to savings of financial resources in USD/year
1000	200-1000	200	Access to the savings of financial resources in transactions and over the years
$>50\%$	10-50%	$<10\%$	The quality of guidance and guidance
$<10\%$	10-40%	$>40\%$	Bureaucracy
$<30\%$	30-50%	$>50\%$	tax burden
>10	10-2	2	Growth centers/technology parks
$>50\%$ success	10-50% success	$<10\%$	Accelerators quality
>50	10-50	<10	Existence of companies with complex technology
>80	80-20	<20	The influence of established companies
$<th$ 15	th20-15	$>th$ 20	The quality of human capital
>0.75	0.75-0.5	<0.5	Cultural values suitable for entrepreneurship
$5.0<$	$5.0-4.0$	<4.0	Technology transfer processes
$>60\%$	20-60%	¡20%	Knowledge of methodology
>5	5-3	<3	Specialized media players
Fully available	Partially available	Inaccessible	Ecosystem data and research*
2	1	0	Ecosystem generations*

Results of step 2:

After the second observation of the ecosystem and with a more comprehensive understanding of how ecosystems function, we recognized the type of literature and theoretical gap in describing ecosystem dynamics. The result of the second iteration of startup ecosystem analysis was that we need a practical method to identify where each ecosystem is in its evolutionary process.

Based on the main elements discovered during the phase 1 and 2 case studies, we presented the first version of a model to explain the maturation process of startup ecosystems. The purpose of presenting this primary model was to organize the evolution process of ecosystems in four maturity levels: emerging level (M1), gradually evolving level (M2), maturity level (M3) and self-sufficiency and independence level (M4). The classification criterion of each level was presented in the research. Even though this initial model follows the two ecosystems we have studied so far, we decided to triangulate the third case study in New York City. The goal was to prove whether 1) the ecosystem fits the model or 2) the model needs modification.

Phase 3 results: New York City case study following maturity model

According to Boulder's thesis, a successful ecosystem has four characteristics: 1) entrepreneurs manage it; 2) it is so comprehensive that it can be accepted by everyone; 3) the people who deal with it are committed to it long-term (at least for 20 years); 4) There are many opportunities to collect items including many events. New York is a very intuitive example of Boulder's thesis:

- Even if part of the driving force and jump for the New York City ecosystem comes from the direct efforts

of Bloomberg's administration (i.e. the mayor's office) to support growth centres, accelerators and co-working spaces, entrepreneurs are still the main agents with whom it all begins. One of the professors of entrepreneurship stated: "Wherever there are two or three very good entrepreneurs, an ecosystem will be created with the efforts of these two or three entrepreneurs."

- Events become visible and discoverable so that people gather together and create a community. The largest tech meetup in the world, New York Tech Meetup, has 50,000 members. In 2014, the city officially launched Digital.NYC, is an online hub for the startup ecosystem, bringing together startups, investors, events, floors, job opportunities, accelerators, news, blogs, videos, and startup resources.
- Inclusivity: Everyone is welcome in this cultural mix of New York City. When you look at startups, you come across founders from dozens of different nationalities. Additionally, compared to Silicon Valley, twice as many startups are founded by women. The New York Tech Meetup and other events engage people of all ages, from seniors to children, watching startups pitch in.
- Long-term commitment: The first generation of entrepreneurs who led their startups to successful exits and played a role in the creation of New York angels and many other investor groups are a good example of sustainable commitment; As the program of KernelTech (Cornell Technology) is; A program written in 2009-2011. The goal of the Cornell Tech program was to establish applied science entrepreneurship courses and build a new university campus on Roosevelt Island. The construction project started in 2014, it is expected to open in 2017 and be completed in 2037.

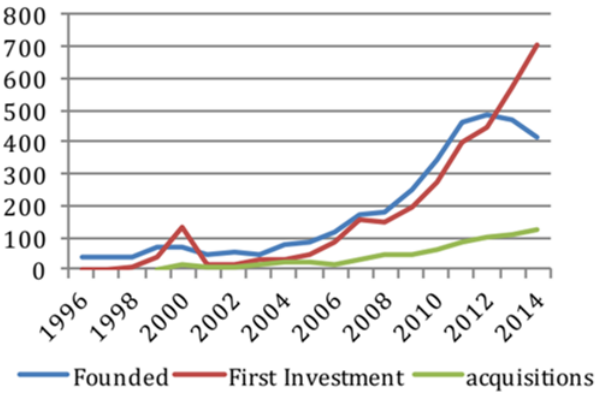

Chart 1: New York-based companies and number of annual first investments. Source: Our chart comes from Crunchbase raw data.

Combining the long-term commitment of entrepreneurs with many inclusive startup events results in a highly cohesive and integrated ecosystem. The theory shows that the success of innovation ecosystems depends on the high level of interaction between its actors [**?**]. New York City has several highly connected entrepreneurial networks and a successful company such as DoubleClick, which was acquired by Google and created a network effect. Howard Morgan, co-founder of New York Angels, explains why: "Exits like that (US billion) are essential to the growth of a high-tech ecosystem; Because well-paid engineers and managers take risks in other startups

Table 5: Startup ecosystem comparison table

Necessary factors* (12) L1 L2 (10) (10) L3 Complementary factors L2(5), L3(3) L2(1), L2(11) L1(5), L2(7)
Emerging maturity level (M1), gradually evolving (M2), self-sufficient (M4)

c) Name the stages that the ecosystem goes through. Do they retreat or disappear?

Four stages that the ecosystem passes through are defined: emerging, gradually evolving, mature, and self-sufficient. The transition between these stages is slow and takes years. Sometimes classification is confusing, especially when moving between these stages.

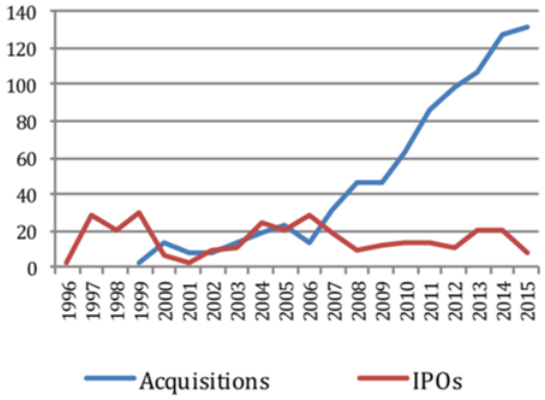

Chart 2: New York Startup Acquisitions and IPOs Source: Our chart is from Crunchbase raw data.

5.3 Startup Ecosystem Maturity Model: Final Version

Two new essential factors were added to the maturity model:

1. access to the financial resources of Farshet Kho. "Startup communities think that they are not complete if they don't have at least one group of angel investors". Many interviewees mentioned the great importance of role models. From the point of view of technology startups, it is important that these models include not only successful people in the business field but also developers and technology managers.
2. Events: In New York City, there is almost a consensus that social networking spaces and events are important for ecosystem maturity [5].

Startup events: Native events that emphasize topics such as startups and high-tech entrepreneurship are held several times. The relevant framework element is community/events.

Financial resources of Fareshtakho in transactions and over the years: Counting the number of transactions by Fereshtakho investors. Mature ecosystems seek more support from angel investors, as angels are usually successful entrepreneurs who return their earnings to the community. The related framework element is financial institutions/angels.

L3	L2	L1	**Factor**
≥ 2	1	0	Exit solutions*
$> 40\%$	$10 - 40\%$	$< 10\%$	Global Market*
$> 10\%$	$2 - 10\%$	$< 2\%$	Entrepreneurship in universities*
> 0.75	$0.75 - 0.5$	$< 0.5\%$	Cultural values suitable for entrepreneurship*
Daily	weekly	monthly	Startup events*
Full	minor	N/A	Ecosystem data and research*
2	1	0	Ecosystem generations*
$> 50\%$	$50 - 10\%$	$< 10\%$	The quality of guidance and guidance
$> 10\%$	$10 - 40\%$	$> 40\%$	Bureaucracy
$< 30\%$	$30 - 50\%$	$> 50\%$	tax burden
$> 50\%$	$50 - 10\%$	$< 10\%$	Quality of Accelerators (Success Percentage)
$1B <$	$B1 - M200$	$< M200$	Access to financing source in USD/year
$15th >$	$th20 - 15$	$> th20$	The quality of human capital
> 0.5	$5.0 - 4.0$	$< 4.0\%$	Technology transfer processes
$> 60\%$	$20 - 60\%$	$< 20\%$	Knowledge of methodology
> 5	$5 - 3$	< 3	Specialized media players

The final version of the factor classification of the startup ecosystem maturity model and the corresponding values for each level are displayed in Table 6.

Relatively measured factors (per million population)

We have created an abbreviated version of the model depicted in Table 7 to make the model easier to publish and better understood. In order to classify the level using the summarized version, the analyzed ecosystem must have at least 7 (out of 8) factors classified in that level.

Table 6: Factor classification of ecosystem maturity model: final version

L3	L2	L1	factors
>K1	K1-200	<200	Number of startups*
>50	5-50	<5	Angel financing in transactions and over the years*
> 10	10-2	<2	Existence of companies with complex technology*
>300	50-300	<50	Access to funding sources in transactions and over the years
>5	5-2	1	Growth centers/technology parks
>10	10-2	<2	The influence of established companies
			Necessary factors*

It is important to mention that, depending on the maturity level of the ecosystem, the criteria for measuring the degree of importance are different. Some metrics are more important to measure and grow during the first years of ecosystem growth, while other metrics are more appropriate when the ecosystem has reached an advanced level of maturity. Table 8 summarizes the classification based on the importance of the criteria. This table does not help local representatives and workers focus their efforts on which parts more in the ecosystem growth process.

Table 7: Ecosystem Maturity Model: Abridged Version

M4	M3	M2	M1	Maturity factor
Self-sufficient	puberty	Gradual evolution	Newfound	Exit solutions
Several M&As and IPOs	Several M's and A few IPOs	Few	nothing	Entrepreneurship in universities
>=10%	10%	2-10%	<2%	Angel financing
Very	To a certain extent	Irrelevant	Irrelevant	Cultural values suitable for entrepreneurship
>0.7	0.7-0.6	0.6-0.5	<0.5	Specialized media
enough	several	Few	nothing	Ecosystem data and research about it
Full	minor	nothing	nothing	Ecosystem generations
>=3	2-1	0	0	events

Table 8: Ecosystem maturity model - importance of measurement criteria

M4	**M3**	**M2**	**M1**	Maturity measurement criteria
***	***	*	*	Exit solutions
*	**	***	***	Entrepreneurship in universities
***	**	*	*	Angel financing
**	***	***	***	Cultural values suitable for entrepreneurship
***	***	**	*	Specialized media
***	**	*	*	Ecosystem data and research about it
***	**	*	*	Ecosystem generations
*	**	***	***	events
very important *, important **, less important ***				

6 Conclusion

Following the need to adopt a comprehensive approach to the category of promoting and supporting productive entrepreneurship - which leads to economic growth - in the current research, the elements are explained and the nature of the startup ecosystem is taken into consideration and according to the nature of the startup ecosystem and the necessity of creating Systematic and all-round changes in this approach in three phases and case research in three regions, we achieved a mature and evolved model in Iran's startup ecosystem. In this study, three study phases have been used to investigate the startup ecosystem and its maturity and evolution path. In the first phase, a conceptual model was obtained according to the case study of Brazil and the elements of its startup ecosystem and was used as a road map. The first phase was to determine the components and factors that define the startup ecosystem, and the relationship between them was also examined. In the second phase, to validate and refine the map produced in phase one, as well as to provide a maturity model for the evolution process of the startup ecosystem. It is Iran. The evolved model was presented in this phase. In the third phase, the goal was to refine and validate the evolutionary and maturity model presented in the second phase, which completed the last phase of our multiple research cases.

In addition to the above, innovation-oriented countries have a mature startup ecosystem, whose intertwined elements include a range of infrastructural and institutional factors to support financial institutions, because entrepreneur-

ship plays an essential role in maintaining the competitiveness of innovation-oriented countries and achieving Higher economic growth and development in these countries depends on innovation.

One of the important components of the startup ecosystem is access to financial resources and risk capital. Meanwhile, investment angels, venture capitalists, growth centers and acceleration centers have a very important place in the process of financing entrepreneurial activities and start-ups. Especially in innovation-oriented countries, in addition to investment angels, venture investors, growth and acceleration centers in Support and support for start-ups have a strong and effective presence because, in addition to needing various resources to obtain more capital, entrepreneurs need training, advice, speeding up the process of entering the market and connecting to the network of entrepreneurs and investors; The growth center and accelerator facilitate the process of growth and transformation of ideas into business and entering the market by providing necessary resources and institutional support. Networks play a very important role in entrepreneurial processes (for example, identifying business opportunities and accessing to technology and resources) - especially in the first years of setting up the company. In the ecosystem of these countries, there are large companies with high growth, which leads to the creation of reproductive companies by attracting talent. and they play a role in strengthening and improving the functioning of the ecosystem. The market is another important element of the entrepreneurial ecosystem of innovation-oriented countries, the development of which is of great importance because the extent to which entrepreneurs turn to technical innovations and specialization depends on the size and performance of the market. it depends; Therefore, the market can be considered as a driver of economic growth and development. The emergence of the entrepreneurial ecosystem depends on the development of markets for newer technologies. Another important element of the ecosystem is culture; A culture that is not afraid of failure and risks and values entrepreneurship. Also, the entrepreneurial ecosystem has an environment rich in information that allows people to know the new market needs of new and evolving technologies.

In general, for innovation-oriented countries, policymakers can positively affect entrepreneurship by promoting and promoting entrepreneurship education and training, by stimulating foreign direct investment and international trade to facilitate export spillovers. Factor-oriented countries should strive to become efficiency-oriented by focusing on achieving a stable and stable institutional environment and macroeconomic environment and increasing entrepreneurial capacities (for example, by enabling individuals and businesses to absorb knowledge spillovers) [1].

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