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## ORIGINAL RESEARCH ARTICLE

# Ecosystem Entrepreneurship Model for University with a Knowledge-Oriented Approach

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## ABSTRACT

This research aims to develop an entrepreneurship ecosystem model within a university, utilizing a knowledge-oriented approach. The role of universities in ensuring the success of knowledge and entrepreneurship goes beyond knowledge transfer. Ultimately, they contribute to the creation of a knowledge-based entrepreneurship ecosystem.

Therefore, experts' opinions were used to identify the indicators, components, and dimensions of the entrepreneurship ecosystem of Azad University. This was done by examining the existing theoretical foundations and utilizing the theme analysis method of Brown and Clark in the ATLAS TI software. In this regard, interviews were conducted with 20 experts from the university's entrepreneurship ecosystem until theoretical saturation was reached. The text of the interviews was then analyzed using coding. According to the systematic model, eight main categories were identified. These clusters include "structural factors (structure and government)", "entrepreneurial fields (environmental factors, management factors)", "entrepreneurial consequences (development and transfer of entrepreneurship, technological entrepreneurship)", "educational and cultural factors (educational factors, cultural factors, scientific and technological factors)", and "policymaking and planning (government policymaking, leadership policymaking)". Knowledge-based entrepreneurship is faced with a complex set of components that create its knowledge-oriented ecosystem. So that each dimension of this sphere is integrated into both the internal components of the university and the higher education system, as well as the external components and subsystems of society. ©authors

## 1. Introduction

The role that universities play in ensuring the success of knowledge and entrepreneurship goes beyond the transfer of knowledge. Ultimately, universities are responsible for creating a knowledge-based entrepreneurship ecosystem (Baharestan et al., 2023). In the aftermath of the economic downturn triggered by the 2008 financial crisis, governments in high-income countries are increasingly looking to universities to play a role in stimulating regional economic development. Consequently, there is an increasing role for today's universities to drive innovation and foster knowledge-based entrepreneurship in order to accelerate regional competitiveness and promote economic growth (Audretsch et al., 2022). The demand for the commercialization of academic knowledge has increased, and universities are becoming more involved in activities related to knowledge maintenance and transfer (Ali et al., 2019). Through their initiatives to improve organizational budgets and government actions to support wealth production and competition, universities create the context of a knowledge-based entrepreneurial ecosystem (Radko et al., 2022).

Governments around the world, particularly in high-income countries, are seeking technological innovation and the application of knowledge as catalysts for national economic growth. They view universities as key contributors to this national capacity (Weerasekara et al., 2022). From this perspective, universities, which function at the crucial junction of education, research, and knowledge dissemination, are regarded as pivotal catalysts in the process of knowledge commercialization and the establishment of an entrepreneurial ecosystem (Theodoraki et al., 2022). The term "knowledge-based entrepreneurship ecosystem" is often used in this context to describe universities that are utilized entrepreneurially to contribute to economic development (Badzińska, 2021). Knowledge-based entrepreneurship represents an interconnected set of different components that support each other in the

birth of new entrepreneurs (Dutta et al., 2021). New businesses also emerge because they are situated in an environment or "ecosystem" that facilitates and supports entrepreneurship (Hsieh et al., 2020). An efficient knowledge-based entrepreneurship ecosystem is needed to foster the development of knowledge-based entrepreneurs. The government encourages academics to become entrepreneurs (Kamel, 2022). The government recognizes that the role of entrepreneurs in determining the progress of a nation has been proven by several developed countries, such as America and Japan, as well as neighboring countries like Singapore, Malaysia, and Thailand. According to the research findings of Hermanto et al. (2017), universities play a crucial role in fostering future entrepreneurs. Because university graduates have a much broader vision and can develop innovative models, they are better prepared to become entrepreneurs. In line with the conducted research, an entrepreneur, according to Jack & Anderson (1999), will be able to succeed if they have scientific abilities and entrepreneurial knowledge.

According to Mack & Mayer (2016), the role of universities in fostering potential entrepreneurs is crucial. They argue that universities should strive to create a productive entrepreneurial ecosystem. The role of each component in the ecosystem, such as the faculty, is important in creating the social network of future entrepreneurs. While, according to Autio et al. (2014), policies in knowledge commercialization play an important role in creating a knowledge-based entrepreneurship ecosystem. Entrepreneurial activities by universities can potentially encompass a wide range of knowledge domains, including patenting and licensing, knowledge commercialization, science parks, and knowledge-based start-ups (Sun et al., 2020). These activities require universities to expand their traditional role beyond teaching, research, and the management of professors and students (Secundo et al., 2021). Members (faculty, students, and staff) of an entrepreneurial university interact with

the non-academic community and businesses in the region to drive innovation and form a knowledge-based platform for creating businesses, thus establishing an entrepreneurial ecosystem (Wang et al., 2021).

Therefore, universities with entrepreneurial performance create organizational structures that can enhance the commercialization of knowledge. They do this through incentive structures, support for patenting and licensing activities via technology transfer offices, and by providing leadership to support entrepreneurial thinking, actions, institutions, and capital. (Radko et al., 2022). University support for entrepreneurship can be divided into three categories: educational support (providing general knowledge and skills needed by a business), targeted cognitive support (creating awareness, motivation, and business perspectives in learners), and non-cognitive targeted support (providing financial assistance) (Gubbins et al., 2020). The numerous benefits of entrepreneurship education have been emphasized and recommended by researchers and educators. However, the impact of entrepreneur support programs, particularly on entrepreneurial attitudes and tendencies, has not been thoroughly tested and requires further research (Ncanywa et al., 2022).

Now, the question arises: How can we contribute to the creation and development of knowledge-based entrepreneurship ecosystems in Iran, based on knowledge indicators? No significant research has been conducted in Iran to answer this question. The focus of entrepreneurship researchers and policymakers is mainly on the entrepreneurial university and its support, while knowledge-based entrepreneurial ecosystems have not received much attention. Therefore, this research aims to answer the question: What is the model of the entrepreneurial ecosystem in the university with a knowledge-based approach?

## 2. Literature Review

The 21st century has been introduced as the century of knowledge. In this era, the main

capital of societies is the knowledge, skills, and attitudes of their human resources. An extensive literature is available, often combining the innovation ecosystem and entrepreneurial ecosystem perspectives to examine the transition of universities from closed innovation systems (i.e., those focused on academic research outputs) (Compagnucci et al., 2020) to open innovation systems (i.e., those that are related to industry with the aim of identifying applications of research outside the university) (Meoli et al., 2016). This literature characterizes the production of knowledge-based entrepreneurship results. Universities are expected to play a central role in the development of entrepreneurial capabilities. Universities are expected to provide a flow of innovation and entrepreneurial capabilities needed by society in the country (Ahmad et al., 2018). Also, the university can cultivate entrepreneurial capabilities, such as knowledge, skills, and an entrepreneurial attitude, in graduates. As agents of social change, these graduates can then promote these capabilities within society (Vazifeh Dolatabad et al., 2023).

Today, knowledge-based entrepreneurship is an advanced and attractive ideal for higher education (Coral et al., 2022). In the future competitive world, universities have no choice but to embrace university entrepreneurship in order to survive (Novela et al., 2021). To achieve this goal, changes should be made in educational and research processes, structures, culture, and the way and content of interactions between universities, companies, and the government. The emergence of universities, which aim to acquire knowledge and understand the realities of existence, has been the catalyst for numerous developments in human societies (Boh et al., 2016). With the expansion of universities, not only have they trained the human resources needed by society (Lenzer et al., 2021), but they have also provided the intellectual and cultural infrastructure for society to enjoy new methods and technologies (Giuri et al., 2019; Prokop, 2022). One of these developments is the growth of entrepreneurship. The

university plays a crucial role in the development of entrepreneurship. Creating and developing entrepreneurs within the educational system and fostering an institutionalized culture requires the identification and implementation of policies and principles that offer effective solutions (Lahikainen, 2020).

In the review of the conducted research, Enezari (2018) states that in the context of the academic entrepreneurship ecosystem, the analysis of Iran's knowledge economy indicates that the most significant weakness of Iran's economy is the absence of innovation processes and entrepreneurial innovation for profit. Embracing new knowledge and technology. These processes are developed within the framework of Banyan University's entrepreneurial ecosystems, which currently do not have a significant presence in Iran's economy and are not widely recognized. Therefore, knowledge-centeredness is the neglected link between the entrepreneurship ecosystem and the university (Jame Bozorgi et al., 2023).

Simmons et al. (2014) also discussed the importance of knowledge entrepreneurship originating from the university. Marcolongo (2017) has shown that the knowledge-based entrepreneurship ecosystem enables students to generate employment ideas. Ezzati Rad et al. (1401) introduced the concept of the university as a foundation for knowledge commercialization and the development of a knowledge-based entrepreneurial ecosystem. Noormohammadi Najafabadi et al. (1401) demonstrated that universities that possess intellectual capital, engage in knowledge production, facilitate knowledge transfer, and promote knowledge commercialization, play a crucial role in fostering an entrepreneurial ecosystem. Bagchi-Sen et al. (2020) identified the importance of knowledge commercialization for the development of a knowledge-based entrepreneurial ecosystem. Further, based on the investigations, this research aims to achieve the following goals:

- Identifying the components and dimensions of the entrepreneurial ecosystem at Islamic Azad University

- Creating an entrepreneurial ecosystem model in the university with a knowledge-oriented approach.

### 3. Method

The aim is to identify indicators, components, and dimensions of the entrepreneurship ecosystem at Islamic Azad University using a knowledge-oriented approach. Therefore, in this research, the opinion of experts was used to identify the indicators, components, and dimensions of the entrepreneurship ecosystem of Azad University. Regarding the method of extracting these indicators, it should be noted that this was done by examining the existing theoretical foundations and implementing the text of the interviews using the theme analysis method developed by Brown and Clark, and utilizing the ATLAS TI software. In this regard, interviews were conducted with 20 experts from the university's entrepreneurship ecosystem until theoretical saturation was reached. The text of the interviews was then analyzed using coding. On the other hand, regarding the coding method, it should be mentioned that the Brown and Clark theme analysis process begins when the analyst considers semantic patterns and topics that may be of interest. This analysis involves a continuous back-and-forth between the dataset and the set of codes and data analysis that have been created.

### 4. Findings

Some demographic information related to the experts of the qualitative department is given in Table 1.

*Table 1. Some information of Delphi panel members participating in the research*

Row	Management experience (years)	Gender	Age
P1	5	Man	48
P2	7	Female	56
P3	6	Man	44
P4	11	Female	62
P5	10	Man	61
P6	7	Man	55
P7	7	Man	49
P8	9	Man	53
P9	7	Man	51
P10	8	Man	54
P11	5	Female	47
P12	7	Female	50
P13	9	Man	59

P14	5	Man	48
P15	10	Female	61
P16	15	Man	63
P17	12	Man	57
P18	13	Man	54
P19	14	Female	56
P20	11	Man	57

**Theme analysis and coding by the Brown and Clark method**

*First step: Getting to know the data*

In order for the researcher to fully understand the depth and scope of the data, it is necessary for them to immerse themselves in it to some extent. Immersion in data usually involves repeatedly rereading and

actively analyzing the data, searching for meanings and patterns.

*Step 2: Creating Initial Codes*

The second stage begins when the researcher reads the data and becomes familiar with it. This step involves creating basic code. Codes introduce a feature of the data that appears interesting to the analyst. The coded data differ from the units of analysis (themes). Coding can be done manually or using software programs. A manual coding method was used in this research.

**Table 2. Initial codes of interviews with university entrepreneurship ecosystem experts**

Row	Codes	Interview
1	The perspective of entrepreneurship in Azad University	Considering the importance of creating employment, there is a need to create knowledge-based entrepreneurship goals and strategies in the university
2	Having entrepreneurial infrastructure	All the necessary infrastructure, both physical and spiritual, should be provided in the university. Resources such as financial conditions as well as motivational conditions
3	Physical communication infrastructure in the university	Internet, social networks, inter-university scientific articles and reports are all the basis of knowledge-based entrepreneurship
4	Refer to the successful experiences of entrepreneurship in Azad University	Based on the knowledge that can be used in the industry in society, pay attention to successful experiences, identify the gap between science and industry, and identify knowledge-based entrepreneurship.
5	Financial and moral support for entrepreneurial universities	Government policies are important in providing financial infrastructure. Intellectual support is valuable in maintaining intellectual property. All are necessary to encourage knowledge-based entrepreneurship.

*Step 3: Search for optional codes*

This step involves categorizing the different codes from the previous step into selective codes and organizing all coded data summaries. The researcher begins the analysis of their codes and considers how different codes can be combined to create an overarching theme. In this stage, the researcher obtained 112 selective codes (indexes) with the assistance of supervisors and consultants. At this stage, the researchers discarded incomplete or unrelated codes, as well as duplicate codes, in order to arrive at the final set of selective codes.

Step 4: The formation of sub-themes (components).

The fourth stage begins when the researcher creates a set of themes and bases them on data. This stage includes two sub-stages: reviewing and refining, and forming sub-themes. The first stage includes a review of the coding summaries at the level of detail. In the second step, the validity of the sub-themes within the data set is considered.

At this stage, the researcher identified 15 sub-themes (components).

Step 5: Defining and naming sub-themes, also known as main dimensions.

The fifth stage begins when there is a clear depiction of the themes. In this stage, the researcher identifies and defines the main themes that will be analyzed and reintroduces them into the study. Then, it analyzes the data within them. By defining and revising, the nature of what a theme is discussing is determined and it is determined which aspects of the data each main theme contains. At this stage, after going back and forth among the sub-themes, the researchers finally reached 4 main themes (the main dimension), which can be explained in the desired context.

*Step 6: preparation of the report*

The sixth stage begins when the researcher has a set of main themes that are completely abstract and consistent with the contextual structures in the research. This stage includes the final analysis and writing the report that will be presented at the end.

After conducting Delphi rounds and consulting with research experts, a number of indicators were removed, components were merged, and the total number of indicators decreased from 112 to 79. Similarly, the number of components decreased from 15 to 11. These components

and indicators were identified across five dimensions for the entrepreneurship ecosystem of Azad University.

**Table 3.** Dimensions, components, and indicators of Azad University's entrepreneurship ecosystem

First index: structural factors		
Structure	1	The perspective of entrepreneurship in Azad University
	2	Creating new platforms for entrepreneurship in universities
	3	Access to physical communication infrastructure
	4	Access to Fava infrastructure
	5	Access to skilled and semi-skilled labor
	6	Availability of sufficient hardware and software facilities.
Government agents	7	The amount of opportunity for entrepreneurship development
	8	The existence of government support services for the entrepreneurship sector in universities
	9	Financial and spiritual support and support of the enterprising and innovative university
	10	Allocation of necessary credit to research institutions and...
The second indicator: consequences		
Development and transfer of entrepreneurship	11	Technological business
	12	Science and technology parks
	13	Attention to accelerators in the promotion and development of entrepreneurship
	14	Use of technical knowledge
	15	Creation of technological startups
Technological entrepreneurship	16	Technological goods
	17	Technological universities
	18	Technological value network
	19	Technology-based knowledge
	20	The transfer of technological entrepreneurship and its commercialization
The third indicator: Entrepreneurial fields		
Environmental factors	21	Market feasibility
	22	Expanding business areas
	23	University interactions with industry
	24	Attention to social problems
Management factors	25	Detailed planning
	26	Core competency
	27	Motivation and passion in business
	28	Using experienced managers with a spirit of innovation and entrepreneurship
	29	Applying innovative management system
Fourth indicator: educational-cultural		
Educational	30	Avoiding traditional and non-practical education
	31	Teaching new skills and professions in universities
	32	Relating educational programs to the needs of the labor market and society
	33	Existence of courses and problem-oriented projects of applied research
	34	Paying attention to fostering creativity and innovation in students
	35	Availability of suitable consulting services
	36	Sufficient attention to internship courses

Cultural	37	Attention to cultural similarities between university and business
	38	Similar motivations in academia and the business sector
	39	Articles, scientific and research publications
	40	Expanding research culture and inspiring environment
	41	Creating the context for creating entrepreneurship motivation in students
	42	Preference for self-employment and expansion of self-employment culture among students
	43	Media-social norms and success stories
	44	Holding conferences, meetings and scientific conferences and...
	45	The existence of a supportive culture of entrepreneurship in universities,
	46	University and industry trust
Science and technology	47	The existence of scientific and research centers in the field of entrepreneurship
	48	Production, transfer and transparency in knowledge sharing
	49	Conducting fundamental and applied research in the field of entrepreneurship and business
	50	Cooperation with various national and international industries and associations and institutions and unions
	51	Technology transfer and commercialization
	52	Attention to the invention and its registration
	53	Establishing entrepreneurial markets in universities
The fifth indicator: policy making and planning		
Government	54	The university's strong understanding of the needs and priorities of the industry sector
	55	Adequate attention to entrepreneurship in macro university policies
	56	Adoption of appropriate and operational plans by the government in order to realize the formulated general policies
	57	Existence of appropriate insurance-welfare coverage
	58	lack of change in government policies,
	59	Avoiding the use of personal policies
	60	Existence of a suitable road map and systematic thinking of the state of entrepreneurship
	61	Considering entrepreneurship as synonymous with job creation in policies and decisions
Leadership	62	The existence of a comprehensive entrepreneurship development program in universities
	63	Managers' support for innovation and creativity and...
	64	Paying attention to and applying the rules for the promotion of faculty members
	65	Management system and experienced and innovative managers
	66	Managers' support for intellectual property and optimal commercialization of inventions
	67	The stability of government managers and employers

The Delphi technique was used to assess the reliability of the coding. The results are shown in Table 4.

*Table 4. The results of the Delphi rounds of dimensions and components of the entrepreneurship ecosystem of Islamic Azad University*

The results of the second round of Delphi		The results of the first round of Delphi	Components	Dimensions	standard deviation	The results of the third round of Delphi	Row
standard deviation	Average	Agreed number				Average	
0.73	7.93	15	Entrepreneurial structure	Structural factors	0.65	7.76	1
0.60	7.69	15	Government agents		0.57	7.81	2
0.73	8.14	14	Development and transfer of entrepreneurship	Implications of entrepreneurship	0.49	7.93	3
0.73	8.22	16	Technological entrepreneurship		0.75	7.42	4
0.83	7.66	15	Environmental factors	Entrepreneurial fields	0.81	7.66	5
1.11	7.61	16	Management factors		0.93	7.54	6
1.08	7.93	15	Educational factors	Educational-cultural factors	0.86	7.67	7
1.29	7.98	16	cultural factors		0.94	7.83	8
1.24	8.13	15	Scientific and technological factors		0.86	7.92	9
1.12	7.23	17	government policy	Policy making and planning Dimensions	0.85	7.65	10
0.84	8.14	16	Leadership policy		0.91	7.54	11

Based on the results of the Delphi rounds, the calculated Kendall's coefficient for the responses of the panel members was 0.658, indicating a strong consensus among the panel members. Therefore, it is possible to end the repetition of the rounds. After the second round of Delphi, once again, the

obtained data was analyzed, which finally led to the emergence of 5 dimensions and 11 components, and the final model of Azad University's entrepreneurial ecosystem appeared in Figure 1.

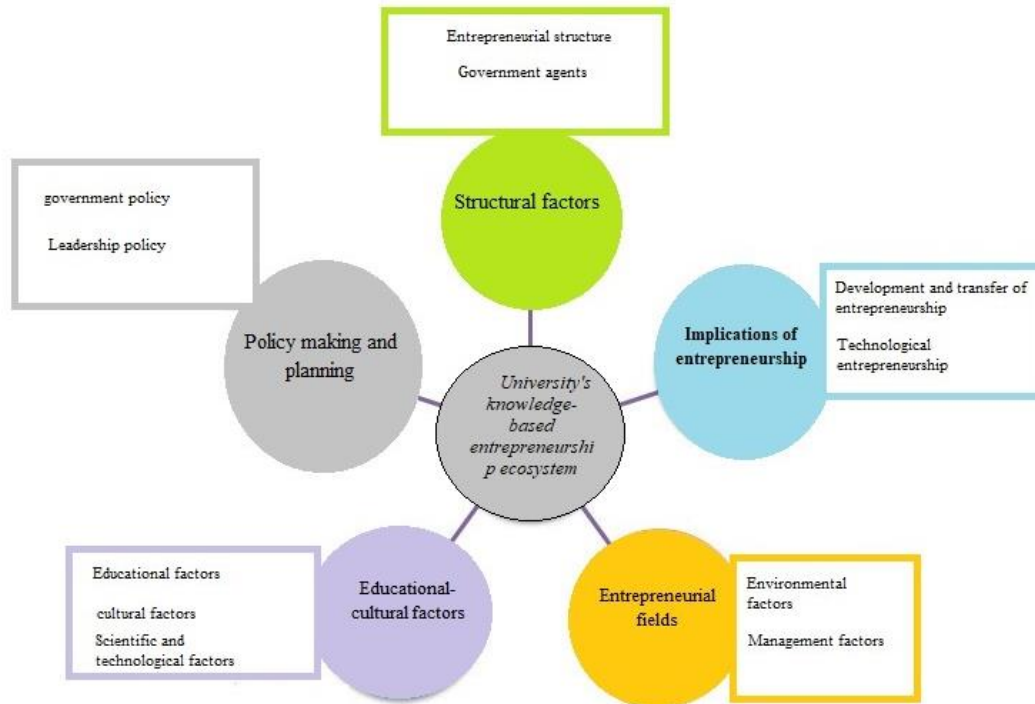


Figure 1. The final model of Azad University's knowledge-based entrepreneurship ecosystem

## 5. Discussion

The purpose of this research was to design and test the entrepreneurship ecosystem model at Islamic Azad University using a knowledge-oriented approach. According to the systematic model, eight main categories were identified in the majority of clusters: "structural factors (structure and government)", "entrepreneurial contexts (environmental factors, management factors)", "entrepreneurial consequences (development and transfer of entrepreneurship, technological entrepreneurship)", "educational and cultural factors (educational factors, cultural factors, scientific and technological factors)", and "policymaking and planning (government policymaking, leadership policymaking)". The findings of the research indicated that the first and most important factor influencing the entrepreneurial ecosystem model at Islamic Azad University was

"educational factors". The results of the present study are consistent with previous research.

The results of the present study showed that "management factors" are the second most influential component of the entrepreneurial ecosystem model at Islamic Azad University. These factors include detailed planning, core competence, motivation, enthusiasm in business, the use of experienced managers with a spirit of innovation and entrepreneurship, and the implementation of an innovative management system. These aspects are considered important in the evaluation of this index. In terms of prioritization based on the average of the factors, this factor was ranked as the second highest priority from the point of view of the respondents. The results of the present research are consistent with the studies conducted by Panahi et al. (2022), Inteziri (2018), and Ezzati Rad et al. (2014).

The results of the present research showed that "scientific and technological factors" ranked as the third most influential component of the entrepreneurial ecosystem model at Islamic Azad University in terms of importance. Scientific and technological factors refer to the application of knowledge in the industry, often through collaboration with universities. The findings of the present research are consistent with the studies of Nanni (2019), Mousavi et al. (2018), and Mohammadpour et al. (2019). According to the research findings, the most influential component of the knowledge-based entrepreneurship model at Islamic Azad University was identified as "cultural factors" in terms of importance. The commercialization and transfer of knowledge to the industry are rooted in the culturalization of the knowledge-based entrepreneurship ecosystem. The findings of the present research are in line with the studies conducted by Moghgar et al. (2019), Elia et al. (2020), and Guerrero et al. (2020). The fifth influential index on the entrepreneurial ecosystem model at Islamic Azad University was "environmental factors". Issues such as market feasibility, business field expansion, the interaction between universities and industries, and addressing social problems are some of the key concerns covered by this index. In terms of prioritization based on the average of the factors, this factor was ranked as the fifth priority from the respondents' perspective. The findings of the present research are in line with the studies of Davari et al. (2016), Meyer et al. (2020), and Prokop (2022). Efficient governmental legislative policies are among the factors that have had a positive effect on the development of knowledge-based companies. This finding was well supported by the existing research literature in this field. The findings of the present research are in line with the studies of Attarari (2018), Lenzer and Kulczakowicz (2021), and Sun et al. (2020).

## 6. Conclusion

The knowledge-based entrepreneurship university ecosystem is built upon a range of structural factors, including entrepreneurial

structure and government factors. It also encompasses entrepreneurial contexts, such as environmental and managerial factors. The ecosystem aims to achieve entrepreneurial outcomes, such as the development and transfer of entrepreneurship and technological entrepreneurship. Additionally, it takes into account educational and cultural factors, including educational factors, cultural factors, and science and technology. Policymaking and planning, including government policymaking and leadership policymaking, are also integral components of this ecosystem. This ecosystem provides an environment where administrative barriers are reduced, and university, government, and community policies support entrepreneurial behaviors. The spirit of taking risks and not being afraid of failure is encouraged through the commercialization of knowledge and knowledge-based activities. Entrepreneurship training programs are offered either officially or through active entrepreneurship associations. The dynamism and sustainability of the ecosystem of the knowledge-oriented entrepreneurial university lie in the comprehensive understanding and integration of all factors and conditions. Universities that have successfully expanded and promoted entrepreneurship in their region, and have been able to create fully functional knowledge-based entrepreneurial ecosystems, possess the characteristics of comprehensiveness and attentiveness to internal and external conditions. The findings of the current research reveal that knowledge-based entrepreneurship is confronted with a complex array of components that form its own knowledge-oriented ecosystem. So that each dimension of this sphere is integrated into both the internal components of the university and the higher education system, as well as the external components and subsystems of society. Based on the obtained results, the following suggestions are presented:

- Attention and promotion of technological products.
- Promoting the transformation of the university into a technology-focused

institution and fostering the commercialization of knowledge

- Expanding technology-based knowledge in university courses.
- Transferring technological entrepreneurship and its commercialization at universities
- Have the necessary planning to effectively teach new skills and knowledge in universities.
- To provide the necessary framework for establishing a connection between educational programs and the demands of the labor market and society.

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### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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