Entrepreneurship Education and Research in Iran: The Faculty of Entrepreneurship of University of Tehran

Mohammad Reza Zali, Mahshid Tootoonchy, Jahangir Yadollahi Farsi, and Nezameddin Faghih

Abstract Entrepreneurship is widely associated with prosperity and economic growth by providing employment opportunities, promoting efficiency by applying new technologies and addressing environmental changes. To encourage entrepreneurial intention and success, the entrepreneurship education aims at providing knowledge, enhancing skills and motivating the students in different contexts. The entrepreneurship education can be offered at two levels of schools and universities. The school level entrepreneurship programs increases the long-term possibility of creating a new business. In order to enhance the entrepreneurial competencies, universities need to contribute not only to the research and teaching but also to the commercialization of technology. The commercialization and technology entrepreneurship curriculum can help the graduate students to recognize the opportunity of launching their own new business start-ups. This chapter reviews the growth of entrepreneurship education in Iran and specifically in the University of Tehran. The current educational programs are explained and the new directions at entrepreneurship education such as techno-preneurship and professional master of entrepreneurship at the faculty of entrepreneurship, University of Tehran are discussed.

Keywords Entrepreneurship education · Entrepreneurship research · The faculty of entrepreneurship

1 Introduction

Entrepreneurship is a dynamic process of transformation, implementation of new ideas and creative solution (Kuratko 2003). Entrepreneurship education is a response to the fast changing, and complex environment to equip people with entrepreneurial competencies (Gibb 2002). Entrepreneurship education motivates job creation

M. R. Zali · M. Tootoonchy (✉) · J. Y. Farsi · N. Faghih
The Faculty of Entrepreneurship, University of Tehran, Tehran, Iran
e-mail: m.tootoonchy@ut.ac.ir; faghihnezam@ut.ac.ir; nfaghih@rose.shirazu.ac.ir

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(Hindle 2007; Jones and Iredale 2010; Kuratko 2005; Lackéus 2015; Purzer et al. 2016), economic growth (Gorman et al. 1997; Kuratko 2005; Wong et al. 2005) and globalization and innovation (Henry et al. 2005a, b; Jones and Iredale 2010).

Universities are changing their role to be able to challenge the socio-economic dynamics (Nieuwenhuizen et al. 2016); therefore, it is expected that adoption of entrepreneurial approach and commercialization of research outputs is the right solution (Goldstein 2010) to adapt to the dynamics of environment. This shift to the role of universities is known as the "entrepreneurial turn" (Goldstein 2010) or the "third mission" (Nelles and Vorley 2010).

Entrepreneurship can be taught (Purzer et al. 2016; Standish-Kuon and Rice 2002) and Entrepreneurship education facilitates the transfer of technology (Lackéus and Williams Middleton 2015). First, the literature on entrepreneurship education will be reviewed. Second, entrepreneurship in Iran and specifically in the University of Tehran as the pioneer university in providing minors, courses and experimental modules will be introduced. Then, the entrepreneurial approach and ecosystem in the University of Tehran will be analyzed. Finally, the new direction of entrepreneurship education in the University of Tehran (techno-preneurship) will be explained.

2 Entrepreneurship Education and Research in World

Entrepreneurship education is conceptualized as a learning process (Cope 2005; Kakouris and Georgiadis 2016), a cognitive process of knowledge transfer (Baron 2004; Mitchell et al. 2007), a high-level learning process (Rae and Carswell 2000) or a meta-cognitive (Kakouris 2015).

Both entrepreneurial courses and pedagogies (Fayolle 2013; Pittaway and Cope 2007) and real-life entrepreneurship learning (Cope 2005; Politis 2005) have been practiced. The content of entrepreneurial education varies in different programs because each discipline has a unique perspective to entrepreneurship (Henry et al. 2005a). Examining 38 entrepreneurship programs, Streeter et al. (2002) confirm that entrepreneurship programs move toward multi-disciplinary trend aim at featuring specific content. Thompson et al. (2010) propose a conceptual model and state that knowledge or experienced based learning of entrepreneurship is associated with different entrepreneurship programs like lectures, case studies, simulation and role play and new venture-based learning. Goldstein (2010) argues that modern universities aim to change their missions from the "Ivory Tower" and the "Land-grant" to the "Triple Helix" or Entrepreneurial University model. Morris and Kuratko (2014) propose different structural forms for entrepreneurship education, namely: General Entrepreneurship Programs, Entrepreneurship Centre (or Institute), Department of Management And Entrepreneurship, Department of Entrepreneurship, School of Entrepreneurship.

There are various approaches to entrepreneurial education (Antal et al. 2014; Neck and Greene 2011). In the United States, a variety of minors, majors, certificate programs and experiential learning have been offered because of the dynamic

Fig. 1 The five Cs framework adopted from Morris and Kuratko (2014)

economic environment (Duval-Couetil et al. 2016). Universities should pay attention to entrepreneurship research, education and cooperation with entrepreneurs (Kuratko 2005).

To empower the students and transform the institution, Morris and Kuratko (2014) propose the five Cs framework to let the entrepreneurship grow and sustain. Figure 1 represents this framework in short.

Nieuwenhuizen et al. (2016) identify and compare the best practices of entrepreneurship education in the United States, Canada, China & Singapore, Europe & United Kingdom and Africa; this study concludes that at undergraduate level a generic and specialized module is preferred while at postgraduate level, universities prefer a greater degree of specialization and interdisciplinary programs. Galloway and Brown (2002) argue that development of entrepreneurship university education facilities creation of high growth ventures.

In the next sub-section, the trend of entrepreneurship education in Iran will be explained.

3 Entrepreneurship Education in Iran

The entrepreneurship development plan was implemented in 2003 as a part of the Third National Development Plan in 12 Iranian Universities. The plan supported entrepreneurship centers, science and technology parks, entrepreneurship courses in universities and promotion of entrepreneurial spirit (Karimi et al. 2010). During the Fourth National Development Plan, entrepreneurship education was more supported. Now (in 2017) around 121 universities have established entrepreneurial centers across the country.[1]

Table 1 represents the development plans duration and their effects on entrepreneurship education.

Former studies of entrepreneurship education in Iran focused on the effects of entrepreneurship education programs on entrepreneurial intentions of students (Karimi et al. 2012), trends and challenges of entrepreneurship education (Karimi et al. 2010), and removal of barriers to entrepreneurship education courses offered in Agricultural Applied-Scientific Education Centers (Rahmanian Koushkaki et al. 2012).

[1]From http://karad.irost.org/kcenters.php

Table 1 Iran's development plans

Plans	Effect on entrepreneurship education
The Third Development Plan (2000–2004)	Implementation of KARAD in 2003 at 12 universities (allocation of budget to education, job creation, support of entrepreneurship centers and technology parks)
The Fourth Development Plan (2005–2009)	Entrepreneurship development through education, promotion, and direct and indirect support initiatives
The Fifth Development Plan (2010–2015)	Financial support of the private sector to develop and expand business, entrepreneurship, technical, professional, and practical training
The Sixth Development Plan (2016–2021)	Developing new technology and supporting the knowledge-based companies by providing financial support for universities and institutions of higher education. Developing internship programs (according to article 17 of the Sixth Development Plan)

4 Research Method

Following Honig (2004), this research takes the equilibrium perspective to study the trend of entrepreneurial education in the University of Tehran. The equilibrium perspective is a dynamic process of interaction with the environment, assimilating new knowledge and applying this new knowledge to increase the level of sophistication.

This study achieves methodological fit within intermediate theory (Edmondson and McManus 2007). Therefore, a case study design is the proper method of collecting data. In case studies both types of qualitative and quantitative data are applied; the evidence may be retrieved from a combination of verbal reports, archival records, observations and/or quantitative data (Yin 1981). As recommended by Yin (1981, p. 60) "narrative-writing" helps a researcher to integrate evidence from various sources of data. Therefore, different informants within the Faculty of Entrepreneurship have been chosen to record their stories of entrepreneurship education in Iran and specifically University of Tehran. The archival records of the University of Tehran have been investigated accordingly. As the national development plans are initiated and are still guiding the development and progression of the Faculty of Entrepreneurship, the development plans have been reviewed as well.

5 University of Tehran as the Pioneer of Entrepreneurship Education and Research in Iran

The University of Tehran as pioneer in the field of entrepreneurship education, established the Entrepreneurship Center in 2001. Table 2 represents the timeline of entrepreneurial top activities in the University of Tehran since early 1980s.

Table 2 Time line of University of Tehran

2001	2002	2003	2007	2008	2009
Entrepreneurship Centre was established at Pardis Technology Park (PTP)	Entrepreneurship Centre was established at UT Entrepreneurship as major of Business management was established at Business department of the Faculty of Management of UT	Entrepreneurship department was established at the Faculty of Management of UT Establishment of Master program in Entrepreneurship at the Faculty of Management of UT	Faculty of Entrepreneurship in UT and also, GEM Iran office was established in this new Faculty of Entrepreneurship	Entrepreneurship e-Learning Centre was established and online Master's degree programs started	Publication of the Journal of Global Entrepreneurship Research and Entrepreneurship Development at the Faculty of Entrepreneurship
2010	2011	2013	2014	2016	2017
UNESCO Chair in Entrepreneurship of at the Faculty of Entrepreneurship	PhD in Entrepreneurship at the Faculty of Entrepreneurship was offered in 13 majors	Publication of the Journal of Global Entrepreneurship research at the Faculty of Entrepreneurship by Springer	Collaboration with UMU, Samson, Turkey about how to become an Entrepreneurial University	Collaboration with UMU, Samson, Turkey about how to become an Entrepreneurial University	Toward minor in Techno-preneurship, minor in Entrepreneurship and pitch panel with collaboration of college of Engineering and other faculties of UT and professional master of entrepreneurship

6 Entrepreneurship Education at the Faculty of Entrepreneurship, University of Tehran

Founded in 2007, the Faculty of Entrepreneurship offers extensive curricula in entrepreneurship. The Faculty of Entrepreneurship has four departments of Entrepreneurship Development, New Venture/ Business Creation, Corporate Entrepreneurship, and Technological Entrepreneurship. The Faculty of Entrepreneurship is also offering E-learning education for more than 700 students.

6.1 Formal and Certificate Program of Entrepreneurship

The Faculty of Entrepreneurship, as a graduate school, is offering both master and PhD programs as well as DBA and MBA courses. The details of these courses are explained in the next sub-sections.

6.1.1 Academic Master Program of Entrepreneurship

The Academic Master's degree program in Entrepreneurship includes the majors of New Venture/Business Creation, Technology-based Entrepreneurship, Public Sector Entrepreneurship, Development Entrepreneurship, Entrepreneurship Education and Extension, Tourism Entrepreneurship; Agricultural Services Entrepreneurship, Corporate Entrepreneurship, Information Technology-Based Entrepreneurship, International Entrepreneurship, and Electronic Business.

6.1.2 PhD Program of Entrepreneurship

The PhD program includes some general courses followed by specialized courses for each of the four majors of Business Creation/Venture, Corporate/Organizational Entrepreneurship, Development Entrepreneurship, and Technology-based Entrepreneurship. The general courses are: Research Methods in Entrepreneurship, Philosophy of Entrepreneurship theories, Philosophy of Management Theories, Philosophy of Organizational Behavior Theories, Philosophy of Islamic Values in Management and Entrepreneurship, Entrepreneurial Opportunities.

6.2 Certificate Program of Entrepreneurship

6.2.1 MBA of Entrepreneurship

Besides the formal courses in different majors of entrepreneurship master's degree, some specialized courses for MBA (Master of Business Administration) in entrepreneurship like Venture Capital, Product and Financial Marketing, Process Management and Implementation of Entrepreneurship Projects, and Quality Management are offered for owners/mangers. Since 2011, around 995 students have been graduated from MBA of entrepreneurship.

6.2.2 DBA of Entrepreneurship

DBA in entrepreneurship school is a 2-year course targeting business owners, leaders of organizations, management consultants, trainers of management and entrepreneurship, MBA graduates and young entrepreneurs. The main courses in DBA program are: Business Models, Marketing Strategy, Learning Organization, Capital Management, Business Innovation, Business Intelligence, Business Sustainability, Leadership, Future Studies, Business Strategy, Business Research Method, and Business Networks.

The DBA course is designed to increase management and business knowledge and skills of the participants, increase decision-making ability of leaders and enhance understanding of the concepts and practical skills in the business world. All students hold a master degree; some hold PhDs before starting the DBA course. The DBA course had 332 graduates since 2014.

7 Approaches of Entrepreneurship Education in the Faculty of Entrepreneurship, University of Tehran

The structure of universities has faced two transitions. (1) The first transition from a teaching to research universities, called the first academic revolution. (2) The second transition besides teaching and research institutes to universities with economic missions, called the second academic revolution (Etzkowitz et al. 2008). Overall, the best approach to entrepreneurship education is considering the students' need to understand the complexities and nature of entrepreneurial acts (Tracey and Phillips 2007). Another series of research categorizes the education objectives into education "for", "about" and "through" entrepreneurship (Kirby 2004; Mwasalwiba 2010) (Fig. 2).

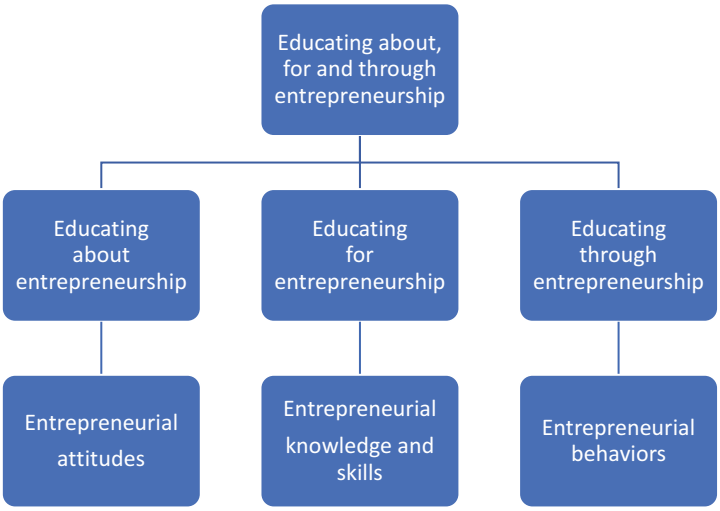

Fig. 2 Approaches to entrepreneurship education

Adopting a theoretical approach teaching "about" entrepreneurship, focuses on entrepreneurial attitudes and aims at giving an overall understanding of entrepreneurship. With an occupationally oriented perspective, teaching "for" entrepreneurship aims at transferring the required knowledge and skills to the promising entrepreneurs. Finally, teaching "through" entrepreneurship, takes a process-based approach to let the students experience the learning process (Lackéus 2015). Kirby (2004) suggests that entrepreneurship education needs to underscore educating "for" entrepreneurship more than educating "about" entrepreneurship. Entrepreneurship is not limited to new venture creation or small business management, but about creativity and change (Kirby 2004); therefore, educational institutions need to change their learning processes to help the students develop both systematic (left-brain analytical skills) and unconventional (right-brain entrepreneurial capabilities) thinking.

Entrepreneurship education needs to move toward a new approach to stimulate entrepreneurial activities in practice. Educating about entrepreneurship is to aim at obtaining a general understanding of entrepreneurship. Educating in entrepreneurship aims at making the students become more innovative in their existing workplace and taking more responsibilities. Therefore, educating "through" entrepreneurship as a new approach emphasis on wider definitions of entrepreneurship while education for and about are designed for higher level students. Educating through entrepreneurship helps the students to achieve business understanding and relevant competencies. Taking this three-dimensional perspective, University of Tehran tends to design the programs to educate the students about, for and through entrepreneurship. Educating for entrepreneurship aims to stimulate the entrepreneurial activities to help the entrepreneurship students to start an innovative business.

8 Entrepreneurial Ecosystem of the Faculty of Entrepreneurship, University of Tehran

The Faculty of Entrepreneurship is the pioneer of executing entrepreneurial events. The following events are the recent activities of the faculty:

- Iranian Entrepreneurial Leaders Festival: recognition and glorification of the top leaders
- Entrepreneurship Commit-Up: letting the two generations of the leaders and young entrepreneurs share their experiences
- The UT Let-Start Weekend program: prepares people to overcome their fear of venturing

Whoever is interested to share their ideas or invest for a start-up is invited to participate in the events. The events help the whole ecosystem to transfer knowledge and spirit of entrepreneurship. The Faculty of Entrepreneurship is the hub to connect different elements of an entrepreneurial ecosystem. The following activities have been carried out in recent years.

8.1 Entrepreneurial Leaders Network as Entrepreneurship Advisors

The Entrepreneurship Leaders' Festival is held every 2 years in Iran. Only five countries in the word are running such festivals. England and United States are the pioneers and after Iran, India and Canada also run the similar festival.

The goal of this festival is appreciation of the entrepreneurship leaders of different industries. The conditions that apply to selection of these leaders are:

– The company should be international: more than 25% of its products should be exported
– Having business relationship with at least three countries
– Engagement in social responsibilities
– The company size should be over 1000 employees

The Faculty has established a network of guest speakers within the entrepreneurship leaders. The guest speakers are invited to talk about their experiences, share their stories and provide consultancy advice to the students.

8.2 Superior Entrepreneurs as Entrepreneurship Advisors

The Ministry of Labor and Social Welfare introduces the superior entrepreneurs each year. The superior entrepreneurs are invited to attend the Sunday evening sessions

regularly to give advice to whoever tends to start a business. The superior entrepreneurs also financially support the students with innovative ideas.

8.3 *Entrepreneurial Students as Entrepreneurship Advisors*

To have a role model in order to launch a new venture is an important factor in an entrepreneurial process. The entrepreneurial students are the students who are running start-ups. These students are invited to share their experiences and give advice to other students in the faculty.

8.4 *Providing Seed Money to Students by Omid Entrepreneurship Fund*

The Omid Entrepreneurship Fund has signed a cooperation agreement with the Faculty of Entrepreneurship. Due to this agreement, a loan is given to the students who present an interesting business plan to create a venture. The business plans are pitched in a pitch panel session; the representative of Omid Entrepreneurship Fund awards the winners.

9 Entrepreneurship Research at the Faculty of Entrepreneurship, University of Tehran

The Faculty of Entrepreneurship has been supporting several research programs on various knowledge areas of entrepreneurship such as new ventures and entrepreneurial opportunities, corporate entrepreneurship, Global Entrepreneurship Monitor (GEM), entrepreneurial ecosystem and business accelerators, entrepreneurship education and promotion, technological entrepreneurship, social entrepreneurship and women entrepreneurship. Table 3 specifically includes the research using GEM data.

After the first report of Global Entrepreneurship Monitor (GEM[2]) in 1999, different waves of research based on GEM' data started. Figure 3 shows the progression of the four research waves.

Iran is the pioneer to start the fourth wave of research in the MENA Region (Middle East and North Africa). GEM data has been used in several research programs from 2001. The Special Issue of the "International Journal of Business and Globalization" ("Networks around Entrepreneurs in the Middle East and North

[2]http://www.gemconsortium.org/

Table 3 The theses using the GEM data

Title of the thesis	Method	Year
Explaining the individual and social factors affecting entrepreneurial intent in countries based on 2008 GEM survey data	Quantitative–Descriptive	2011
Entrepreneurial activity at the national level affected by institutional situation (global study based on GEM data)	Quantitative	2011
The effect of entrepreneurial competencies on generation companies in Iran and Denmark based on GEM data	Quantitative	2012
The impact of entrepreneurial activities on economic growth in selected countries of the global entrepreneurship watch organization (GEM)	Quantitative	2011
The impact of social networking on entrepreneurial competency based on GEM 2010 data	Mixed method	2011
Influence of social network, inclination to innovation, and entrepreneurial opportunity recognition of entrepreneurs based on GEM 2010 data in Iran	Mixed method	2011
Investigating the effect of inter-corporate collaboration on the innovation of Iranian secured businesses (based on GEM 2011 data)	Quantitative	2012
The impact of social networking and family support on the performance of new businesses in Iran and Denmark (using GEM 2011 data)	Mixed method	2011
The effect of organizational entrepreneurship on innovation in Iranian businesses based on GEM data	Quantitative	2012
The effect of organizational roles on business performance in selected countries based on GEM 2011 data	Quantitative	2013
The effect of psychological empowerment on the role of organizational entrepreneurship in small and medium businesses based on the data of 2011 GEM of Iran and Denmark	Quantitative	2013
Analysis of the impact of entrepreneurial social competencies and norms on entrepreneurial motivation based on 2012 GEM data of Iran	Quantitative	2013
The effect of national culture on entrepreneurial motivation in selected Asian countries based on GEM 2011 data	Quantitative	2015

Africa: Composition, Causes and Consequences, Vol, 11, No, 4") specially focused on the MENA region. Table 4 lists the papers published in this special issue.

In order to get support from various sources and obtain more knowledge, entrepreneurs develop a strong entrepreneurial network, called the entrepreneurial ecosystem (Stangler and Bell-Masterson 2015). Etzkowitz et al. (2008, p. 681) argue that there is a global transition to 'entrepreneurial universities' or 'innovative ecosystems' which play a significant role in the knowledge based economy. The entrepreneurial ecosystem has a significant role in leveraging the education resources (e.g. internships, funding etc.) which affects the growth of start-ups (Duval-Couetil et al. 2016; Neck et al. 2004).

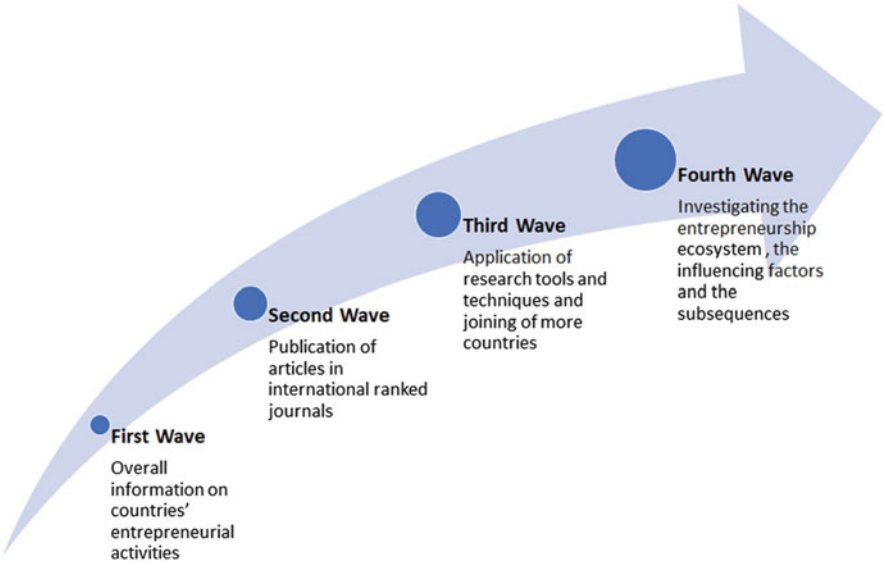

Fig. 3 Four waves of entrepreneurship research of GEM based data

Table 4 List of papers published in the special issue of IJBG

Title	Author
Composition of networks around entrepreneurs: cross-national comparisons in the Middle East and North Africa	Constance Van Horne; Lotfi Belkacem; Taha Ahmed Al Fusail
The effect of national culture on entrepreneurs' networks: a comparison of the MENA region and Denmark	Hadia FakhrElDin; Hazbo Skoko; Maryam Cheraghi
Are entrepreneurial networks shaped by firms' organizational characteristics? A cross country comparison of the MENA region	Yousef Daoud
Entrepreneurs' gender, age and education affecting their networks in private and public spheres: Denmark, Middle East and North Africa	Shayegheh Ashourizadeh; Thomas Schøtt
How individual competencies shape the entrepreneur's social network structure: evidence from the MENA region	Sarfraz A. Mian; Hala W. Hattab
Promoting innovation in the MENA region: the role of social norms and individual factors in entrepreneurial networks	Mohammad Reza Zali; Bettina Lynda Bastian; Shahid Qureshi
Firms' exports promoted by entrepreneurs' networking: MENA and Denmark	Mahdokht Sedaghat; Mohamed Derrabi
Effects of entrepreneurs' networking with national values on job growth expectations: a two-level analysis for the MENA region and Denmark	Tareq Sadeq; Zakia Setti

10 Roles of the Faculty of Entrepreneurship Inside and Outside of the University

Besides designing different courses and programs and supervision of research in entrepreneurship, the faculty is actively participating in designed social activities. Two case studies are described below:

10.1 Case Study 1: KASHEF Plan, Entrepreneurship Promotion in Iran

In order to recognize and enhance the entrepreneurial efficacy among high school students, the Faculty of Entrepreneurship is running the "KASHEF" Plan country wide. With 15 agents in different provinces and over 40 entrepreneurial markets, the Faculty of Entrepreneurship is expanding their free educational services to direct the next generation of young entrepreneurs.

The 9–15 year old talented students are selected. The reason behind the age range is that it normally takes 3 years on average for an entrepreneurial intention to form and let the entrepreneur to start their business. The students are first courage to get a loan from their parents. The real entrepreneurial stories are told in a childish manner to let the young entrepreneurs imagine the success path. In the next step, the students are led to make a handcraft, design a software, etc. and try to sell their product in the entrepreneurial markets. The students are also thought to calculate their little business margin and the tax. Different relevant activities like preparing the balance sheet, tax declaration, market research forms are also taught to the students during this plan. As a part of their social responsibilities, the young entrepreneurs are also encouraged to donate to their selected foundation.

The next plan is co-operating with the Ministry of Education to prepare the high school students to develop their business model and start their own business. The KASHEF plan is being supported by the "High Council of Employment".

10.2 Case Study 2: Advanced VLSI Lab

The advanced VLSI Lab has conducted academic research in order to create knowledge at international level. The lab has been established to carry out the applied research, design and manufacture various products and provide specialized engineering services at national level. Beside the product development, the lab has an active role in compilation of national standards.

The VLSI lab approach is establishing a link between university and industry to empower the students, business development and entrepreneurship for the Advancement of Science and Technology and the national growth. The VLSI lab is an

entrepreneurial lab which is managed entrepreneurially. In fact, the School of Electrical and Computer Engineering and the Faculty of Entrepreneurship are collaborating to help VLSI lab to commercialize technological research and prototypes. The Minor in Techno-preneurship has been designed to help the engineering students and graduates to start their own technological businesses or commercialize their inventions.

10.3 Match-Making and Knowledge Commercialization by Entrepreneurship Research

Knowledge commercialization is the transformation of knowledge into products, processes, and new ventures which contributes to the economic growth (Mueller 2006); therefore, entrepreneurial universities are the means of knowledge flow because knowledge is created in firms or universities before exploitation.

The Faculty of Entrepreneurship is acting as the match maker in order to configure an effective network between entrepreneurs and investors. In playing the new role of matchmaking, the Faculty of Entrepreneurship has conducted some events inside and outside of the country such as organizing business forums between Iranian and Malaysian, Iraqi, Russian and Chinese entrepreneurs and investors.

11 New Direction of Entrepreneurship Education and Research of University of Tehran; Minors and Professional Master in Entrepreneurship

Overall, entrepreneurship education is an innovative continuum of creativity (Duval-Couetil and Dyrenfurth 2012). The innovative education of entrepreneurship is connected to the technology-oriented programs and engineering (Duval-Couetil et al. 2016) and provides a framework to address "the engineering problems in a social context" (Nichols and Armstrong 2003, p. 137).

The entrepreneurship education is offered as courses and programs specialized for engineering students or as multi-disciplinary courses (Kuratko 2003). Standish-Kuon and Rice (2002) categorize the engineering or technology entrepreneurship programs into three forms:

1. Business schools offering formal curriculums through cooperation with the engineering faculties
2. Engineering schools offering the business schools' curriculums
3. Multi-disciplinary programs offering the engineering entrepreneurship curriculum with active cooperation of the business and the engineering school

Table 5 Comparison of entrepreneurial engineering modules in three case studies

Case study	Structure of modules	Details	Requirements
National University of Singapore (NUS)	Minor in Techno-preneurship in two groups	– Group A (Entrepreneurial Marketing, Technological Innovation, New Product Development, New Venture Creation, New Venture Consulting Practicum) – Group B (Management & Organization or its equivalent, Financial Accounting or its equivalent, Managerial Economics or Introduction to Economic Analysis or Principles of Economics)	Selection of four modules from Group A and two modules from Group B
Purdue University	Minor in Engineering Entrepreneurship	– Required (Engineering Entrepreneurship I & II) – Electives (From Laboratory to Marketplace, Bioengineering Case Studies, Drug Discovery & Development, Intellectual Property and Business Law for Engineers, Engineering Negotiations, Engineering Entrepreneurship Lab, Foundations of Leadership, Special Topics in Human Systems Engineering, Venture Capital and the Finance of Innovation, Venture Capital and Entrepreneurial Management)	Six courses for a Minor in Engineering Entrepreneurship
University of Waterloo	– Minor in entrepreneurship – Entrepreneurship Option in Engineering	– Three core courses (Foundations of Entrepreneurial Practice, Entrepreneurial Strategy, Essentials of Entrepreneurial Planning and Execution) – Five electives (Foundations of Venture Creation, Customer Experience Design, Growing Early Stage Ventures, Capstone Entrepreneurship Planning and Execution, Advanced Topics in Entrepreneurship, Entrepreneurship for Social Impact, Sales Fundamentals, Leadership)	Eight courses and one experiential milestone

Table 5 represents the entrepreneurial engineering modules in three universities.

Duval-Couetil et al. (2016) examine the effects of different entrepreneurial education programs and experimental activities on students' perception of knowledge and skills. The findings reveal that a great number of entrepreneurial courses are associated with higher perception of knowledge, skills and self-efficacy. The multi-disciplinary programs show to have a greater effect on the students' general perceptions.

The engineering entrepreneurship prepare the students to recognize the opportunities related to the products, technologies and solutions, development of technologies for commercialization and funding of ventures (Shartrand and Weilerstein 2011). Duval-Couetil et al.'s (2012) survey within three institutions with established entrepreneurship programs for senior engineering students shows that 69% of

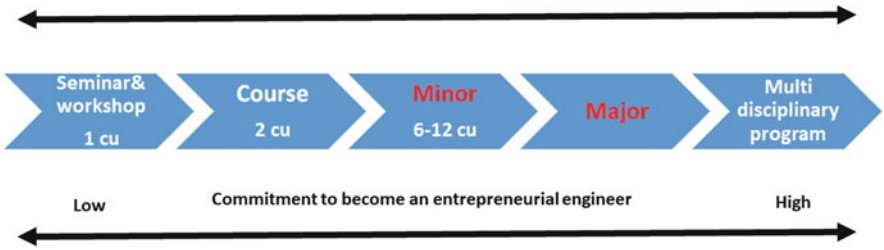

Fig. 4 Models of entrepreneurship education programs

students felt that entrepreneurship education positively affects their career prospects. Purzer et al. (2016) also argue the necessity of entrepreneurship education within engineering courses to help the graduate students to outperform their competitors, implement solutions to major technological problems and cope with economic crises. An entrepreneurial engineer organizes the risk of an engineering business (Nichols and Armstrong 2003; Purzer et al. 2016). Figure 4 shows the models of Engineering Entrepreneurship Education.

The relevance of entrepreneurship education for engineering students have been highlighted in former research (Cristina 2016; Karim 2016; Kriewall and Mekemson 2010; Luryi et al. 2007; Nieuwenhuizen et al. 2016; Streeter et al. 2002). In addition, the effects of entrepreneurship education on students' start-ups (Ochs et al. 2006) and the positive effects of technology entrepreneurship courses on career path of young engineers (Mancenido 2008) have been investigated.

The results of GEM research program revealed that entrepreneurship education increases the entrepreneurial intention and activity. According to GEM program results, there is 20% gap between the innovative entrepreneurial activities between Iran and the United States (GEM website 2016). This gap can be filled by techno-prenuerrship education.

Minor in Entrepreneurship for Engineering Students and Professional Master in Entrepreneurship

In fact, education programs depend on strategic plan of universities. Following the third strategic plan, the University of Tehran has three strategic objectives: (1) to become an entrepreneurial university, (2) internationalization and (3) to enhance University's social and ethical responsibilities.

In order to help the university to reach its strategic objectives (especially the shared vision of entrepreneurial university during the next 5 years), Faculty of Entrepreneurship aims at implementing the entrepreneurship minor at the University of Tehran (Table 6). As Zali and Razavi (2013) research shows the entrepreneurial ideas of engineering students are more technology-driven while the social science students have more market-driven ideas. Therefore, the content of courses, minors of entrepreneurship should be specific for various groups. Table 7 shows the main units of the proposed Techno-preneurship minor by the Faculty of Entrepreneurship.

Table 6 Techno-preneurship courses in University of Tehran

	Long term goals	Specific goals	Course duration/ modules	Main modules
Minor in techno-preneurship	– Developing creative, intelligent, and skillful human resources in setting up a technology business – Strengthening university education in the path to the creation and development of new technology businesses in the private sector – Eliminating graduates' unemployment problem by teaching entrepreneurship skills to engineering students and graduates	– Training of Techno-preneurs to gain – The knowledge of developing product technology and business start-ups – The ability of establishing business start-up	– Both undergraduate and post-graduate engineering students can attend the courses at the same time – Six modules in the form of 12–15 units for master's degree – 15–18 modules for bachelor's degree	– Techno-preneurship – Product design – Design and engineering of techno-preneurship – Strategic management of techno-preneurship – Commercialization and product development – Marketing and internationalization of techno-preneurship

Table 7 The main units of the proposed techno-preneurship minor

Unit name	Hours	Unit name	Hours
Techno-preneurship	32	Strategic management of entrepreneurship, innovation and technology	32
Product Design	32	Product commercialization and development	32
Technological business and engineering design	32	Marketing and internationalization of techno-logical business	32

Basically, master's programs can be professional or academic (please refer to Table 8 for comparison). Both programs prepare students for jobs as working professionals. Programs of academic master's degree allow students to obtain an education in a specialized field of study. Most of these degree programs take about 2 years of study with a thesis. However, recent master's degrees tend to be more business or career-oriented.

As Table 8 shows, the professional master's degree has just three semesters and is a graduate degree designed to allow students to pursue advanced training in entrepreneurship while simultaneously developing business and entrepreneurship skills through internship or new business start-up. The Faculty of Entrepreneurship is currently involved in designing and implementing Professional Masters degrees of entrepreneurship at the University of Tehran.

Table 8 Comparison of Academic and Professional master program

Factors	Academic master	Professional master
Orientation	Science	Practical
Number of semesters	4	3
Thesis	Yes	No
Internship	No	Yes
Start up	No	Yes

12 Conclusion and Suggestion

The Faculty of Entrepreneurship of the University of Tehran is a pioneer in entrepreneurship education. Various entrepreneurship programs, minors and majors in the faculty bring the entrepreneurial efforts together across the university through social gatherings and lectures. A range of diverse formal and certified programs help the keen individuals to choose a desired program along with their educational needs. The scholars come from different disciplines and educational backgrounds like management, engineering, and social science. Some of the scholars are start-ups founders. Beside the formal education programs, the faculty focuses on recognition of entrepreneurial opportunities, link the funders and young entrepreneurs, run different entrepreneurial forums and seminars, International Conferences on Entrepreneurship (ICE), festivals to honor entrepreneurial leaders and educate the talented high school students as prospective entrepreneurs. Linking the "OMID" Foundation to the young entrepreneurs with interesting business ideas let the young talent receive proper financial support. The students can also get entrepreneurship advice from Iran entrepreneurial leaders and entrepreneurs' network.

Taking a new direction in entrepreneurship education, a minor specifically for engineering students has been designed. The goal of this minor is enabling the engineering scholars to set international goals and commercialize their technological products.

Overall, the Faculty of Entrepreneurship takes a long-term visionary perspective to entrepreneurship education, educate the scholars, facilitate entrepreneurial activities and adopt academic and experimental knowledge.

12.1 Contribution

The Faculty of entrepreneurship of the University of Tehran as the first school of entrepreneurship in MENA Region, aligns all its activities to the country's development plans and specifically to the entrepreneurship development. In order to reach the visions and goals, the Faculty of Entrepreneurship strives to:

First, develop the educational courses based on KARAD goals.

Second, develop the business management course in business department.

On the road to establishment of the Faculty of Entrepreneurship, the depth and variety of research and education in Iran have been expanded. The effects of the entrepreneurship education on a number of start-ups have been significant

12.2 Limitations and Future Research

Although, entrepreneurship education is very effective in training young entrepreneurs, the need for evaluation programs has been highlighted in recent literature (Pittaway et al. 2009; Welsh et al. 2016). As recommended by former research (Fayolle 2013; Kakouris and Georgiadis 2016), long-term evaluation of the effects of entrepreneurship education on success of entrepreneurial activities shall be considered. In addition, accepting failure of entrepreneurial activities (Welsh et al. 2016) is a part of the nature of entrepreneurship. Future research may investigate the effects of failures on entrepreneurial intentions.

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