

# The Role of Pre-Incubation in the Development of Entrepreneurial Ideas of Higher Education Students

Original  
Article

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## ABSTRACT

Universities play a crucial role as sources and repositories of dissemination of scientific and technical knowledge, and generating new entrepreneurs. Business and technology incubators are appropriate mechanisms to adopt the initiatives and innovated entrepreneurial ideas within university students. In this paper, a definition of pre-incubation, science and technology parks, and similar institutions was introduced in addition to their impact on the conversion of the students' entrepreneurial ideas and the results of applied research to universities and other research centers to economical products, and in the transition to a knowledge economy. Preliminary data were collected on the role of technology incubators in the field of higher education through the design of a questionnaire, which was sent to the representatives of such facilities in selected locations in the world. An innovative pre-incubation model was designed for implementation. Optional tracks were introduced, which could accommodate the student innovations until graduation, and will contribute to the development of higher education through universities. The idea of this research was engendered from studying the summer training program, which fulfills a graduation requirement in some Arab universities. Students spend a period of training in one of the government agencies or national companies for several weeks, in order to strengthen the capacity of the students participating in the program and improve their personal and practical skills. At the time, this program trained students as future employees, there is another segment of students have the willingness to engage in the world of entrepreneurship and employ themselves by starting their own small businesses. This originated the idea of the "pre-incubation," which is a different path can route some college students to invest these weeks in shaping ideas of their businesses by the assistance of selected professors, so each student can prepare business plan or prototype, which enable him to join later one business or technology incubator or to benefit from one of the funding institutions and get a loan to start his business immediately after graduation. The research was designed as a proposal to be implemented as a pilot project at one of the Egyptian universities for testing and evaluation for dissemination in various Arab universities.

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**Key Words:** Entrepreneurship, higher education, pre-incubation, SMEs development, technology incubators.

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## INTRODUCTION

It is acknowledged today that a nation's standard of living depends on the development of science and technology and adoption of the knowledge economy with the use of the competitive advantages of those nations (*Albert, et al., 2002*). The role of universities has evolved gradually to transform the results of scientific and applied research into final products and modern techniques in the service of society, industry and contributing to economic growth. Existing interaction between universities, technology incubators, science and technology parks, and similar institutions has contributed in the settlement and development of advanced technology and open up new jobs through new enterprises that have been established and the development of existing enterprises (*Shalaby, N., 2008*).

### **Problem Definition**

Finding an appropriate model for the Arab countries higher education pertaining to the real interaction between universities and technology incubators.

## DEFINITION OF INCUBATORS AND SIMILAR INSTITUTIONS

The following is a review of some of the definitions accordance with the objective of the establishment:

Pre-incubator: is a structure where the entrepreneur can work out a business idea until it becomes a prototype; the pre-incubator offers services that help the entrepreneur to clearly define the business and make a primary business plan (*J. Bischoff, 2001*).

### **Technology Incubator**

The term "incubator" signifies a controlled environment to keep premature infants in incubators for the first, critical, days of life. In the context of business development, incubators are used to help the transformation from potential entrepreneur to fully-fledged, profitable enterprise. By reducing the risks during the initial period of setting up a company, incubators help its development and economic growth, and encourage regional revitalization by promoting new firms and jobs (*Knopp, Linda, 2012*).

### **Technology Parks**

A landscaped development usually comprising of high specification office space as well as residential and retail developments, designed to encourage localization of high technology companies such as information technology, software development etc., thereby giving each the benefit of economies of scale. Usually, technology parks are located outside the inner city areas as these are quite land intensive in nature (*Lalkaka, R., 2004*).

### **Technology Pole**

Is an arrangement of organizations with similar objectives that act together in a certain territory. The Poles may have distinct characteristics: they can be science-technology poles, or modernization poles – that promote knowledge creation inside universities and research institutes and subsequent technology transfer to enterprises (*Shalaby, N., May 2009*).

### **Clusters**

Are geographic concentrations of interconnected companies and institutions in a particular field. Clusters are critical to competition because they facilitate the organizations access to suppliers, information, technology and complimentary institutions and promote inter organizational cooperation and performance measuring (*Shalaby, N., 2006*).

### **SERVICES PROVIDED BY INCUBATORS**

The following is a summary of some of the services provided by the incubators for tenants: Basically, the incubator provides the following seven "Ss" (*Lalkaka, R., 2004*):

- Work Space through flexible modular arrangements.
- Shared Office facilities such as receptionist, conference rooms, telephone system, fax, computer, and copier.
- Services such as counseling on management and marketing, accounting, intellectual property and legal matters, through in-house expertise and by networking with external professionals.
- Skills development by training on SME management, marketing and other disciplines.
- Speed in securing the needed office facilities and facilitating the registration, taxes, and other regulations required by governments.
- Seed money access, through the incubator's reputation and better business plans, and often through an internal revolving fund that provides equity or small loans.
- Synergy of sharing and networking, among tenants and with local community.

### **FACTORS OF SUCCESS OF INCUBATORS**

There are success factors of the incubator include the following (*Shalaby, N., 2005*):

#### ***The Strict Selection of Incubator Tenants***

Whenever the selection criteria clear and specific, the chances of attracting good ideas have the capacity to succeed. These standards vary and may include the ability of exponential growth and be related to advanced technologies and provided by a detailed business plan and the possibility that the project developed an innovative idea or invention.

#### ***Incubator Manager***

Incubator manager plays a key role in the success of incubator, where he must have some skills in area of business planning, management, marketing, accounting, in addition to the time spent with tenants inside the incubator and detect problems before they escalate.

#### ***Community Support***

It is important that incubators gain moral support and economic relations at the local level. The support comes from the municipalities or universities or large companies. When it becomes apparent that the incubator is a reflection of the community's goals and has a positive economic development, it is then able to attract support from a wider base.

#### ***Access to Finance***

Applicants for membership of the incubator needed to be nurtured and to know the different financing alternatives. The incubator is able to collect good information from the various sources of financing banks or institutional grants and loan funds and various senior investors.

#### ***Creating Success***

The image can be enhanced through the incubator by a new or renewed building, the existence of links with major local parties, the good links with the media and local public relations, and the association between incubator and its success stories, all of these things help to create opportunities for the success proved incubator and its different.

#### ***Benchmarking and Continuous Improvement***

Incubator needs to evaluate its operations and performance on a regular basis. This does not include the mere control performance in terms of growth and associated facilities, but also includes the growth and development of companies after graduation from the incubator. Such information suggests incubator in the planning and delivery of services. More importantly, marketing itself and attract high-quality promising and expected growth in non-traditional projects.

**GLOBAL GROWTH IN INCUBATORS**

There are about 7000 operating incubators worldwide (Knopp, Linda, 2012), depending on how these are defined, roughly one-third each are in the U.S.A., the other industrial countries (in Europe, Australia Japan, Canada) and the industrializing and restructuring countries. (Figure 1) illustrates the increase in the number of incubators in the world from 1985 until 2012. The figure shows the increase in the number of incubators in the developed countries is a linear increase while increasing steady increase in the case of developing countries. Twenty years ago, the number of incubators in the world total from less than a thousand to about seven thousands incubators now.

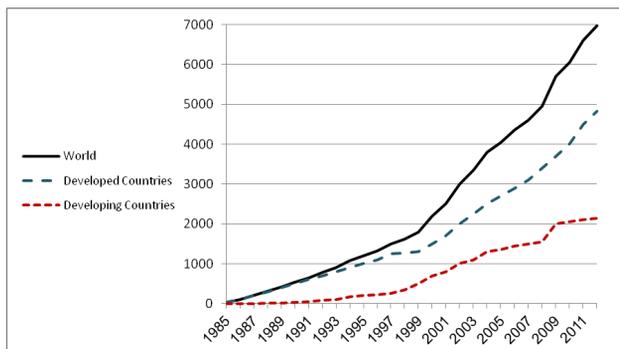


Fig. 1: Incubators have grown rapidly

(Figure 2) shows the distribution of incubators in some countries of the world. It is clear that the United States has the biggest number of technology incubators in the world, and China ranks second in spite of that leap incubators in China began in the 1990s only, while it is apparent that the Arab countries represented in Egypt, in this case, with a small number of technology incubators compared to other countries.

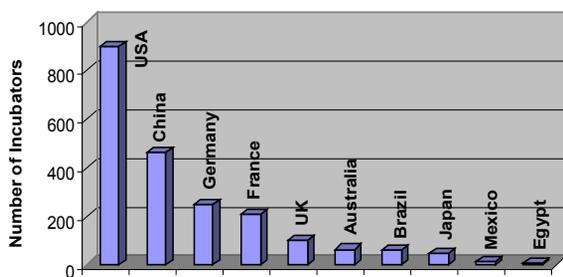


Fig. 2: Distribution of incubators in selected countries<sup>[6]</sup>

**THE QUESTIONNAIRE**

In order to benefit from the experiences of other countries in the field of incubators, that connected to institutions of higher education. A questionnaire has been designed to determine the influence of certain technology incubators in selected countries in the world to the higher education. Despite of the large number of incubators around the world, the methodology of the paper focuses only on

incubators, that related to education, in order to obtain the best results and to select the best experience appropriate for the environment of the Arab countries Therefore, the respondents were closely related to the subject of the paper.

**list of Respondents to the Questionnaire**

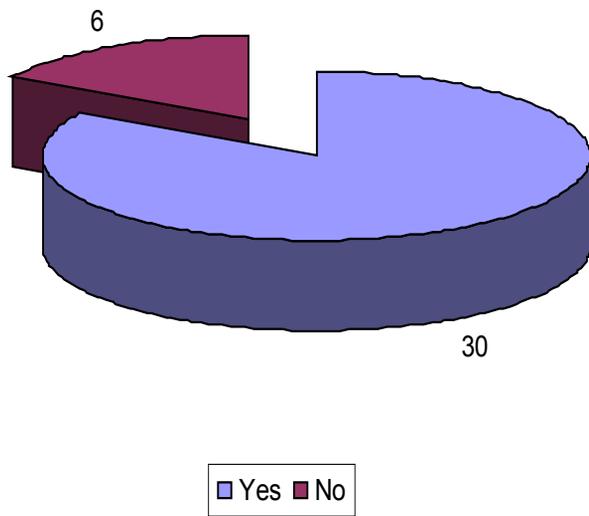
Many regional and international institutions have responded as follows:

1. Portugal-Almada
2. Portugal-Maia
3. Netherlands-Idea Center
4. Denmark-Scion-DTU
5. Estonia-Tallinn
6. Latvia-Riga
7. Finland-Hyvinkaa
8. Australia-Melbourne
9. Singapore-Singapore
10. Canada-Quebec
11. Jordan-Amman
12. Oman-Muscat
13. Developing Countries (By an International expert\*)
14. Romania-Brasov
15. Estonia-TSP
16. Pakistan-NUST
17. Germany-Munich
18. Taiwan-Tainan
19. United Kingdom-Cambridge
20. Turkey-Ankara
21. Egypt-Mansoura
22. Tunisia-Sfax
23. India-Ahmedabad
24. Uzbekistan-Samarkand
25. South Africa- Isando
26. Iran-Tehran
27. USA-Austin
28. Egypt-Tabbine
29. Egypt-Tala
30. Bahrain-Manama
31. USA-San Diego
32. France- Genopole
33. Sweden- Mjardevi
34. USA- Rochester
35. Japan- Kitakyushu
36. South Korea- Soul

(\*) Professor Rustam Lalkaka is an American-Indian expert in the field of incubation. He contributed in success of many of the incubators in 40 countries, including China, Egypt, Indonesia, India, Uzbekistan and other countries.

**Findings**

**1. Does the incubator have a link with university?**

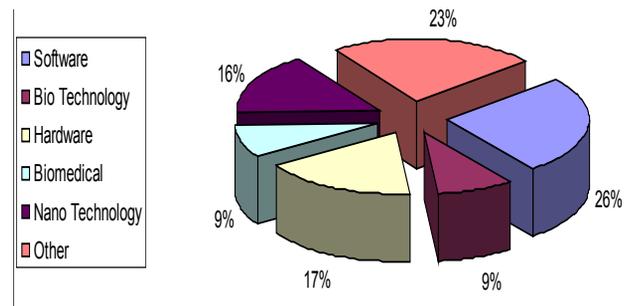


**Fig. 3:** the number of incubators and the relation of university 30 respondents (83%) , the majority of the sample are linked to universities.

**2. Do you offer entrepreneurship training to your tenants?**

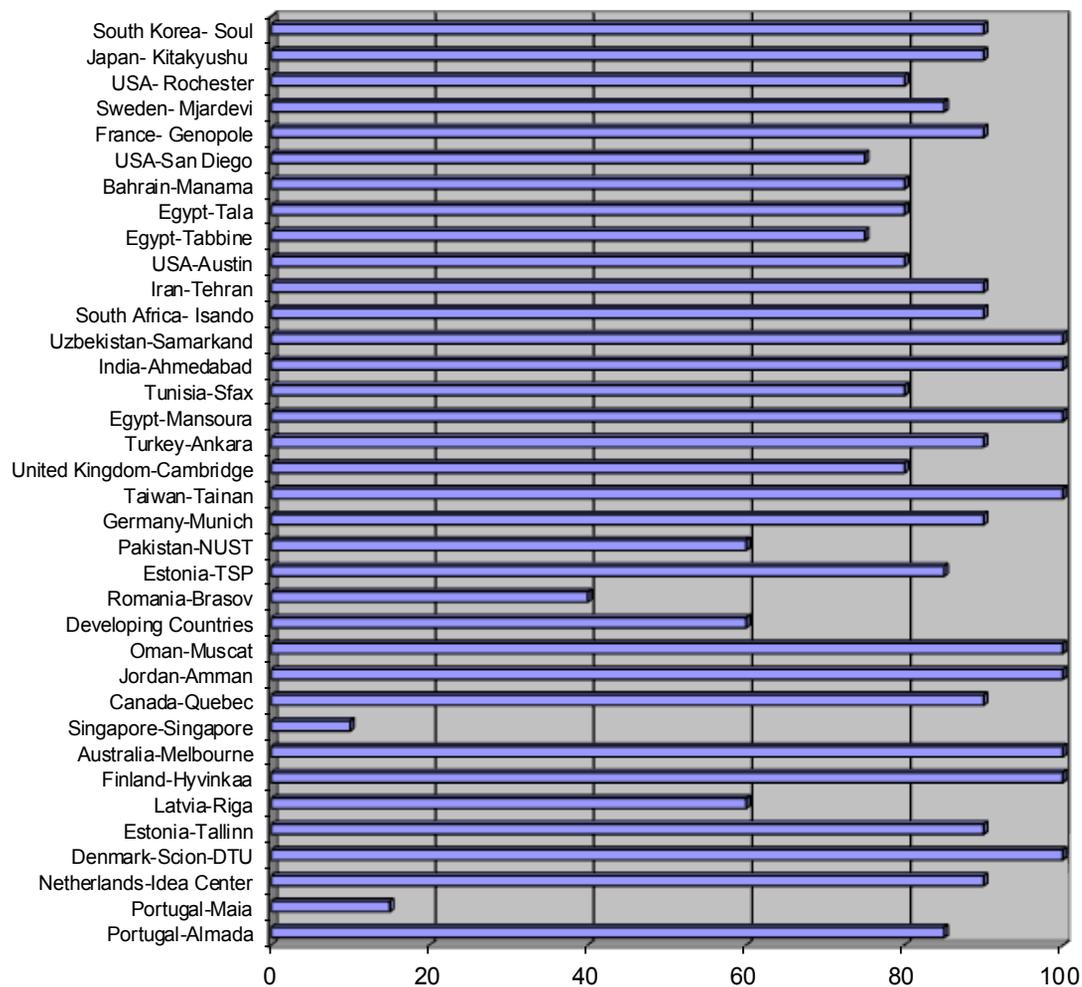
The finding of the survey assures that all incubators provide entrepreneurship development programs before the affiliation to the incubators.

**3. Main business sectors of the university tenants**



**Fig. 4:** Main business sectors of the university tenants

At the top of the list, Software industry sector represents 26%. The second largest sector is hardware, which represents 17%. Bio technology and biomedical sectors represent 9% each.



**Fig. 5:** The percentage of success of the tenants after the first year

**4. The percentage of success of the tenants after the first year**

The average success of the tenants after the first year is estimated by 81%. It represents a high percentage comparing to the success rates of small businesses outside

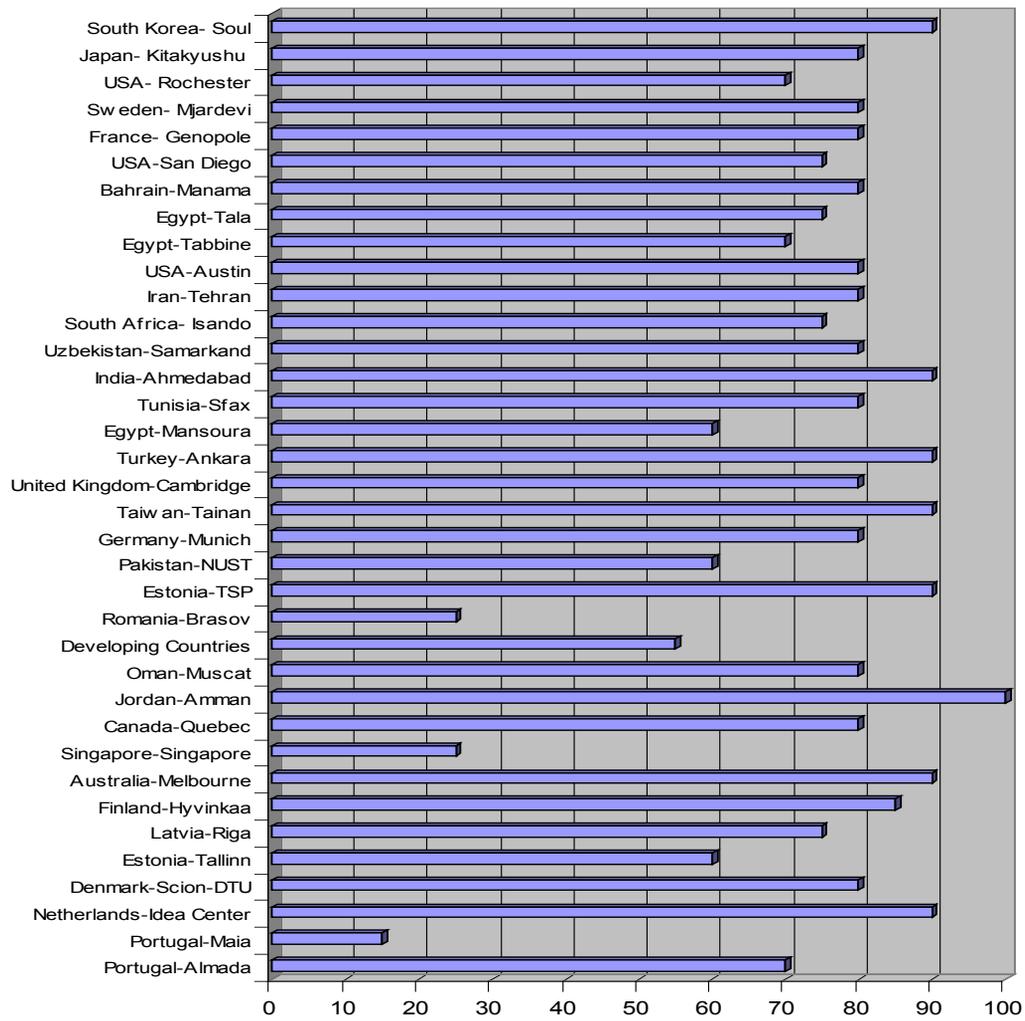


Fig. 6: The percentage of success of the tenants after the first three years

incubators, which do not exceed 25% at the world level.

**5. The percentage of success of the tenants after the first three years**

The average percent of success of the tenants after the first three years of the sample is more than 81%. It is also relatively high comparing to the world level.

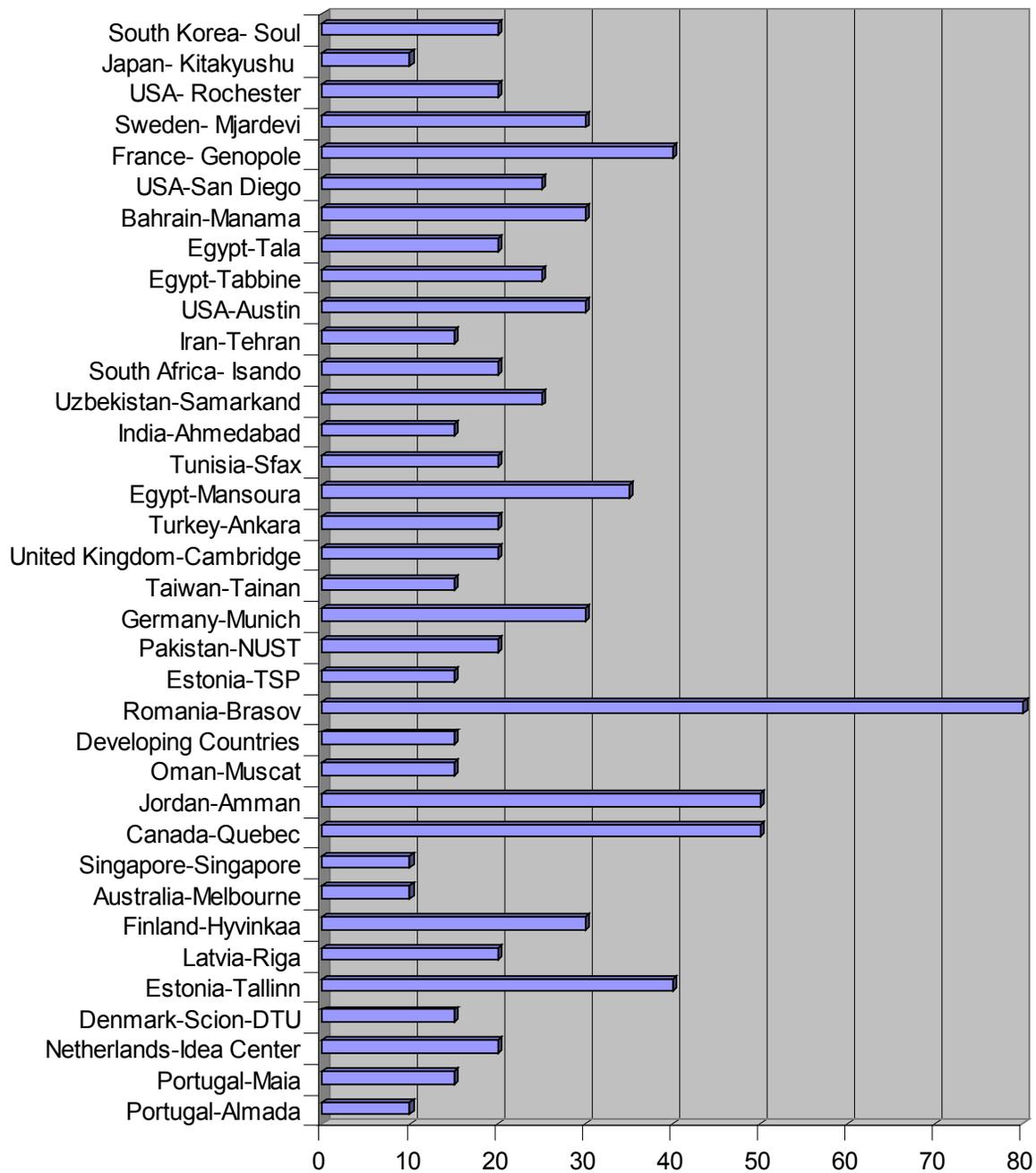


Fig. 7: The average annual percentage of employment growth per firm

**6. The average annual percentage of employment growth per firm**

The rate of growth of employment per firm is between

10% to 50% annually, which represents a large proportion compared to other sectors. It arrived in Romania to 80%, and author considers that this ratio may need to be verified.

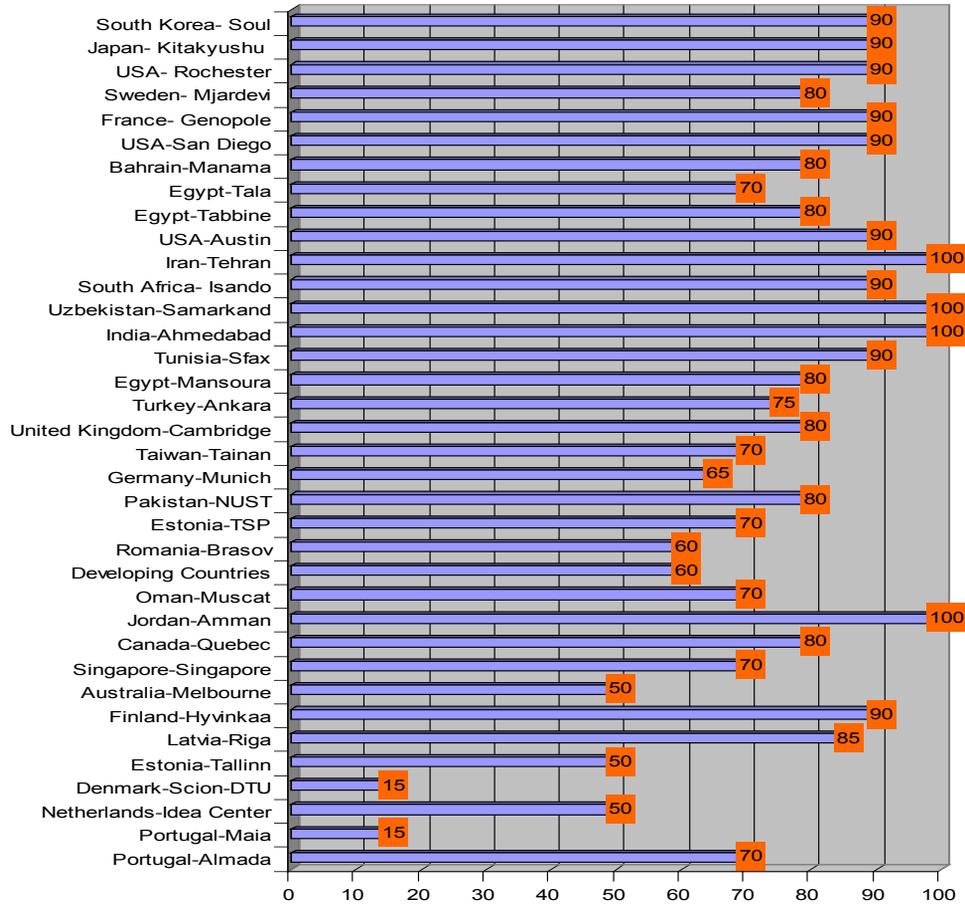


Fig. 8: The percentage of success of the tenants after 1-3 years of graduating

**7. The percentage of success of the tenants after 1-3 years of graduating**

The percentage of success of the tenants after 1-3 years of graduating ranged from 15% in Denmark and Portugal,

to 100% in Iran, Uzbekistan, India, Jordan, as shown in figure (8) and the average success rate for the whole sample was 75%.

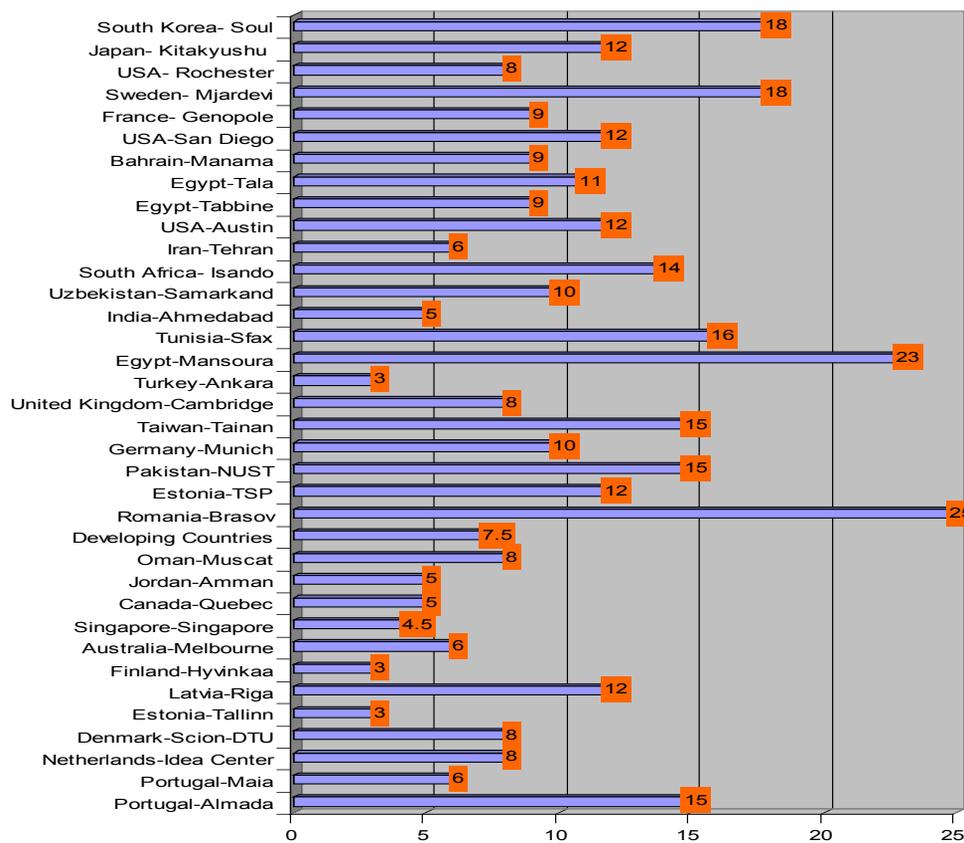


Fig. 9: The average number of employees of incubated university firms

#### 8. The average number of employees of incubated university firms

The average number of employees of incubated firms varies from three employees in the case of Finland and Estonia, to 25 in the case of Romania, as shown in (Figure 9) and averaged 10 employees of the whole sample.

#### *Specialties list of the university tenants of the sample was as follows*

Computer Science- Electronic Engineering- Environmental Engineering- Communications- Software and hardware development- Engineering applications- Industry automation- Instrumentation for bio-tech- Measurement techniques- Energy saving- Uninterruptible power supply- Shipbuilding engineering- Audio-systems- Hardware I.T.C.- Quality Control and Business Analyzing software- Power Electronics and Energy Saving- GSM/GPRS Service software- Elevator and Escalator Engineering- 3D Animations- Micro-precision engineering- Wireless network engineering - Healthcare software solution- Enterprise software solutions - Internet and email management- Design software solutions- Nanotechnology based technology- medical instrumentation.

#### IMPACT OF TECHNOLOGY INCUBATORS ON HIGHER EDUCATION

According to the previous reviews of the experiences of other nations, including Arab countries in the area of technology incubators, It is noticed the increase in the prevalence of technology incubators at the global level, particularly in the last two decades of the 20<sup>th</sup> century until now. We can extract the impact of technology incubators in higher education as follows:

- Technology incubators contribute to the consolidation of ties and the partnership between the university and industry.
- Technology incubators contribute to the transformation of scientific research outputs of university products to be marketed locally and internationally.
- Cooperating between universities in the Arab countries and large industrial companies in the establishment of a technology incubator as part of main objectives, which serve the targets of those companies in addition the entrepreneurs who will benefit from the incubator.

8. THE PRE-INCUBATION OBJECTIVES

Pre-incubator will be created with the goal to promote the emergence of new companies in the Arab universities by helping the students to clearly define their desires and tasks, as well as by providing consultations with mentors and high-quality infrastructure - premises, office supplies, and Internet. The tasks of the pre-incubator offers the provision of consultations for the new entrepreneurs on evaluation and development of business ideas, market research and analysis, and creation of resources for starting a business and provide effective work environment where new entrepreneurs could evaluate and develop their business idea successfully. The following illustration summarizes the pre-incubators objectives:

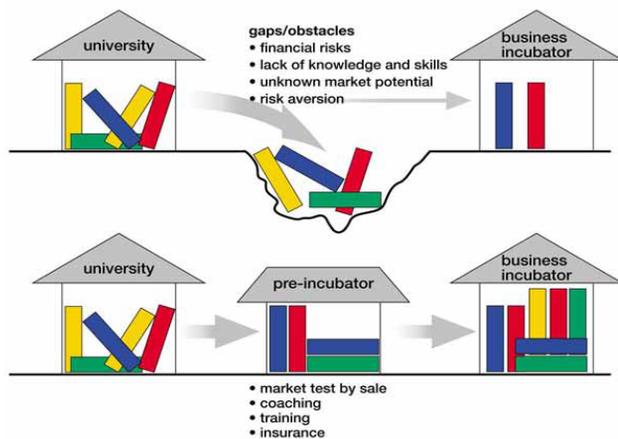


Fig. 10: Summary the pre-incubators objectives

THE MODEL

As a result of the positive role that could be played by technology incubators, the author has designed an innovative model for the activation of this role in most universities in the Arab countries. This model will be applied in tracks chosen by the student himself in the course of study and after graduation. This has been illustrated in (Figure 11). It is apparent from the figure, the steps that will be followed by a student since entering college until graduating as follows:

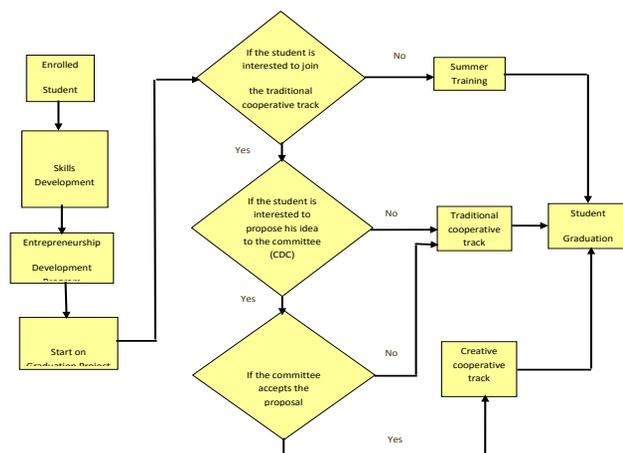


Fig. 11: An innovative model for linking higher education to incubators

Step (1): Student enrollment to the university.

Step (2): The student studies communication skills, working in a team, leadership skills and creative thinking. This is in addition to reverse engineering skills and how to add more value to an industrial product. Student also learns the principles of modeling.

Step (3): The student studies entrepreneurship, where the student learns the skills as a potential entrepreneur, and the creative skills to transform the idea into a business. The student learns the skills of setting up and running a small business. Among the benefit of the student in this program is to contact with the industry through a (Mentor Program). He will find links to several funds options at the end of semester.

Step (4): Thereafter, the student has three choices as follows:

- The student enrolls to the summer training course and implements a specific project to fulfill graduating from university.
- The student joins the traditional cooperative track and does a project in order to graduate from university.
- The student enrolls the creative cooperative track (incubation) and does a project to graduate and then graduating from university.

In the case of the selection of the student the creative cooperative track (incubation), he has to prepare a proposal to be assessed by the arbitration committee (Creativity Development Committee-CDC), consisting of representatives of incubator and a select group of businessmen and financiers to assess the draft graduation project, resulting in the two following directions :

First direction

Committee accepts the proposal and therefore joins the incubator as required by the creative cooperative track (incubation), then turn his idea into a creative business, which has been marketed by the private sector or by the student himself.

Second direction

Committee rejects the proposal and therefore rejects joining the incubator and then returns the student to the traditional cooperative track and ends its requirements and graduate.

CONCLUSION

This paper reviewed the concepts, definitions and classification of incubators, and their relation to higher education. It illustrated the most important factors contributing to their success. The rate has been steady growth in incubators at the world level, and the experiences of selected countries in the field of incubators and the positive impact of the incubator on higher education, and a questionnaire, which was designed and sent to selected incubators around the world. This paper has

proposed an innovative model, which is unprecedented to take advantage of the mechanisms of incubators in the development of education in the Arab countries vis a vis converting students ideas into technological competitive products. Optional tracks were introduced, which could accommodate the student innovations until graduation.

This will increase the contribution of higher education outputs in technological development and economic growth of the Arab countries in a more effective way. This can be achieved through:

- Directing higher education to transform ideas and graduation projects to convert them into successful business ventures.
- Develop the principle of entrepreneurship and leadership among colleges to formalize economic knowledge and intellectual property.
- Linking inputs and outputs of scientific research of universities with the technological applications of technology incubators and technology parks, which will contribute significantly to the building of a knowledge-based economy.

#### **CONFLICTS OF INTEREST**

There are no conflicts of interest

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## Appendix A: Paper's Survey

### ***I. Applicant Information***

1. Applicant Name:
2. Position:
3. City:
4. Country:

### ***II. Incubator Information***

5. Incubator Name:
6. Year of Foundation:
7. Number of Employees:
8. Supporting Phase (Pre-startups – Startups- Existing Enterprises.. other):
9. Are the incubator management includes university staff or educational positions ?  
 Yes                       No
10. Does your incubator have a link with a university?  
 Yes                       No
11. What is the average annual number of tenants in your incubator?

12. Do you offer entrepreneurship training to your tenants?  
 Yes                       No

13. Please check the main business activities of your tenants.

<input type="checkbox"/>	Artificial Intelligence	<input type="checkbox"/>	Communications
<input type="checkbox"/>	Genetics	<input type="checkbox"/>	Energy
<input type="checkbox"/>	Software	<input type="checkbox"/>	Hardware
<input type="checkbox"/>	Biomedical	<input type="checkbox"/>	Nano-technology
<input type="checkbox"/>	Aerospace	<input type="checkbox"/>	Bio-technology
<input type="checkbox"/>	Other activities (Please specify)		

14. What is the percent of success of your tenants after the first year? ( ) %
15. What is the percent of success of your tenants after the first three years? ( ) %
16. What is the average annual percent of employment growth per firm? ( ) %
17. What is the percent of success of your tenants after 1-3 years of graduating? ( ) %

## الملخص العربي

# دور برنامج "الريادي الجامعي" في دعم الأفكار الريادية لطلاب التعليم العالي

نبيل شلبي

مؤسس ورئيس مجلس إدارة المستثمر العربي

تضطلع الجامعات بدور حيوي في نشر المعارف العلمية والتكنولوجية، وتوليد رواد أعمال جدد. كما تعد حاضنات الأعمال والتكنولوجية آليات ملائمة لاحتضان مبادرات وأفكار الطلاب الريادية الإبداعية. في هذه الورقة، تم تعريف مرحلة ما قبل الاحتضان والتي أطلق عليها الباحث "الريادي الجامعي"، حقائق العلوم والتكنولوجيا، والمؤسسات المماثلة، بالإضافة إلى تأثيرها على تحويل أفكار الطلاب الريادية ونتائج البحوث التطبيقية في الجامعات ومراكز البحوث الأخرى لمنتجات اقتصادية، والتحول إلى الاقتصاد القائم على المعرفة. تم جمع البيانات الأولية عن دور حاضنات التكنولوجيا في مجال التعليم العالي من خلال تصميم استبيان أرسل إلى ممثلي هذه المرافق في مواقع مختارة في العالم. وقدمت الورقة تصميماً مبتكراً لآلية احتضان أفكار الطلاب الريادية. وتصميم مسارات اختيارية، يمكن أن تستوعب ابتكارات الطلاب حتى التخرج، وسوف تسهم في تطوير التعليم العالي. وقد نبعت فكرة البحث من دراسة برنامج التدريب الصيفي، وهو أحد متطلبات التخرج في بعض الكليات العملية بالجامعات العربية، حيث يتضمن البرنامج -الذي يُنفذ سنوياً منذ عشرات الأعوام- قيام الطلاب بقضاء فترة تدريب في إحدى الجهات الحكومية أو الشركات الوطنية لعدة أسابيع، وذلك بهدف دعم قدرات الطلاب المشاركين في البرنامج وتحسين مهاراتهم الشخصية والعملية بما يعزز من مهاراتهم الوظيفية والنهوض بها. وبالوقت الذي يرى فيه هذا البرنامج الطلاب المتدربين كموظفين بالمستقبل، هناك شريحة أخرى من الطلاب لديهم القابلية للإنخراط في عالم ريادة الأعمال وبتوظيف أنفسهم بأنفسهم من خلال بدء مشروعات صغيرة خاصة بهم. من هنا نبعت فكرة برنامج "الريادي الجامعي"، وهو مسار آخر يمكن أن يسلكه بعض طلاب الجامعات لاستثمار هذه الأسابيع في بلورة أفكار مشروعاتهم بمساعدة أساتذة مختارين من كلياتهم ليُعد كل طالب مشارك خطة عمل لمشروعه أو نموذج أولي يمكن تطويره من خلال التحاقه لاحقاً بإحدى حاضنات الأعمال أو التكنولوجيا أو لمساعدته بالتقدم لإحدى الجهات التمويلية والحصول على قرض لبدء مشروعه الخاص مباشرة بعد التخرج. تم تصميم البحث كمقترح يمكن تنفيذه بأحد الجامعات المصرية بصورة تجريبية لاختباره وتقييمه تمهيداً لنشره في جامعات عربية مختلفة.