

Entrepreneurship Promotion at Educational Institutions: A Model Suitable for Emerging Economies

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Abstract: - This paper discusses the role of educational institutions in promoting entrepreneurship and risk taking, particularly in conservative communities and cultures. Two main topics are discussed in this paper. The first is tailoring the academic program and all activities supporting it to serve the goal of promoting entrepreneurship. The second topic is to construct a particular form of incubators suitable for emerging economies which is financial resources bound. These incubators serve multiple functions, therefore, in addition to the traditional role of incubating potential-businesses; the other roles are serving as a training site for business-related and soft skills topics for students and serving as an expert house for the industry. This would promote the universities' role in serving and prospering their communities impacting positively the emerging economy. Efforts related to these topics by a Jordanian University will be discussed as the case study.

Key-Words: - Entrepreneurship, entrepreneur; business and academia; incubators; industry-university relationship, emerging economies; academic programs; developing countries.

1 Introduction

Majority of the emerging economy companies are having a hard time due to many reasons of which is the impact of international agreements on traditionally shielded markets residing under closure and protectionism. This has led many companies to rethink their strategies, in terms of restructuring product cost, identifying market niche and capitalizing on it, identifying new markets and exploring them, transferring operations to low-cost labor countries, in addition to creating alliances and mergers.

Under such conditions of stringent competition, one may think that there is a need to a critical mass of small businesses that altogether are able to change the financial landscape of these emerging economies. In Jordan, this explains the number of incubators throughout the country and the effort to encourage and promote small business development through training and even funding. This paper will focus on the Jordanian model as an example of an emerging economy. Focusing on technological entrepreneurship has certain competitive advantage

which could be able to carry the needed regional transformation as shown by Venkataraman [32].

At Jordanian universities, in general, there isn't enough effort exerted in this direction, however, at the Industrial Engineering Department at Jordan University of Science and Technology, a real effort has started to promote this new philosophy which has impacted course content, graduation and class projects, and the extracurricular activities. This paper will address this effort in great details and draw a roadmap for the others to explore. The other part of this paper focuses on incubating promising ideas within special form of University Incubators to the point of spinning-off successful stand-alone businesses.

Jordan has a developing economy that consists mainly of huge service sector and a much smaller industrial sector. Additionally, there is a good size public sector which over the years cultivated in the Jordanians the tendency of seeking secure and comfortable governmental jobs. This culture has created psychology of risk fear. Hence, there are two main challenges that face educators at the Jordanian universities. The first challenge is that

educators themselves are part of the society, and therefore, they mostly share the psychology of low-risk taking. The second challenge is the paradigm shift in students' style of thinking from job seekers to creative and innovative entrepreneurs.

This paper describes certain changes that can be made to academic programs and the activities surrounding it to support this trend of entrepreneurship promotion. This effort; nevertheless, is a huge one particularly knowing that it's getting faculty away from their comfort zone. This is why planning and executing such an academic program should be carried out after the faculty collective consent so as to be committed to the effort and responsible for its results. The other part the paper discusses is the establishment of a special form of incubators. This incubator's role does not end at incubating potentially successful spin-offs, rather, has many other tasks of which is bridging to the industry and collaborate with them. Also, such an incubator offers a training platform to students on soft skills and business-related topics. This paper also discusses the issue of coming up with the seed fund needed to establish such an incubator through special arrangement with the private sector. Challenges facing all such efforts are discussed and solutions are proposed.

2 Literature

The area of entrepreneurship research is relatively new. Literature related to the topics of this paper will be reviewed, namely, entrepreneurship and industry-university relationship.

Entrepreneurship is a trait that is considered to generate innovation and changes rather than respond to them and so causes economic development (Baumol [2]). According to Tidd et al. [32], venture establishment is affected by factors such as: family background, religion, formal education, culture and psychological profile. Ndonzuau et al. [16] focused on one of the most promising ways to transfer research results to the market place, namely, the creation of academic spin-offs. In the United States, according to Alistair et al. [1] and Roberts [24] they claim that academic spin-offs have been part of the academic landscape for decades. Powers and McDougall [20] identified factors and resources that impact number of university start-ups and number of initial public offerings (IPOs) firms to which the university had previously licensed a technology. However, in Europe, these spin-offs are still in their infancy (Stankiewicz [30]). In developed economies, since academic research had contributed to significant number of products and processes in

the market (Mansfield [11, 12]), academic institutions became aware of their ability to exploit research output by promoting and sustaining start-ups. In developing economies; however, academic institutions did not realize this fact yet.

The Organization for European Cooperation and Development emphasized that academic institutions need to develop formal policies to facilitate the transformation of research to new ventures; this was shown in a report titled 'Fostering Entrepreneurship', (OECD [17]). University promotion of entrepreneurship is still in its inception; hence research in this area has just started (Radosevich [20], Roberts and Malone [23], Carrayannis et al. [3], Steffensen et al. [30], Mok [15]). Rasmussen and Sørheim [21] presented several action-based activities that would promote entrepreneurship implemented by a number of Swedish universities (Klofsten [10], Jacob et al. [9]).

Ndonzuau et al. [16] found that in majority of universities they visited, the rules for promotion in the professorship scale are contrary to the entrepreneurial culture. This brings the question of the ultimate end of university research. Resolving this conflict has long been avoided because the scientific model dominates the culture (McMillan et al. [13]). According to this model the purpose of research is either to publish in internationally recognized journals, or to educate students on the latest scientific findings. Hence, scientific research purpose is the public good (Etzkowitz [6], Clark and Lund [4]).

Etzkowitz et al. [6] discuss the need for radical changes in the way academic institutions handle research output. Commercial exploitation of research results implies bringing together two vastly different cultures, namely, scientific-centered and economical-centered (McMillan et al. [13], Shane [27]). The main challenge becomes how to resolve the polarization between them achieving dual satisfaction (Dasgupta and David [5]). The mission to serve the community is also part of academic institutions' role; economic utilization of research output should become a priority (Reitan [22], Shane [27], Powers and McDougall [19]). Santoro [25] stressed that industry-university alliances can be instrumental in facilitating the industrial firm's advancement of both knowledge and new technologies, and this can be done through research centers. These advancements are essential for organizational long-term prosperity and survival. Due to limited expertise and financial resources for most organizations, in-house technological initiatives and breakthroughs are difficult to achieve

(Hamel and Prahalad [7]). Additionally, it was shown by Ireland and Web [8] that internal balancing between exploration and exploitation is distinctive and hence outsourcing exploration to research centers could be a feasible alternative. For sustainable development it is required to have some public sector involvement which can be a major player in creating the bridging between industry and academia as explained by Clark and Lund [4]. Shane [27] has shown that government policies and acts can have a positive impact on number of university patents which impacts university entrepreneurship.

3 University Roles

The primary functions of contemporary universities include the triad of teaching, research, and community service (Phillips [18]). The following sections discuss these functions in more details:

3.1 Teaching

This is usually the main role for universities, by which universities prepare graduates capable of carrying out the national and regional development plans and fulfil the market needs. Currently, in addition to the academic content of the curriculum, there is an increased demand by the market to equip students with soft skills abilities such as communication skills, report writing, presentation skills, emotional and social intelligence, etc.... Therefore, universities are being challenged to produce the well-rounded graduate who has the academic ability combined with the right personality and skills.

3.2 Research

Technological advancement in the advanced world depends on the academic institutions to fulfil their applied research and development needs. In research arena, there is a constant debate on striking a balance between applied and theoretical research. However, due to bigger amount of research effort and funding, not enough applied research is conducted, which drive many researchers toward theoretical type of research. This research direction leads to less value added to the surrounding community which is particularly true for the developing world.

3.3 Community Services

This is an undervalued role of universities which in developing countries is extremely important. Its importance stems from the local organizations' (both industrial and service) need for technical assistance in day-to-day challenges which usually don't rise to the level of scientific research. Most organizations in developing economies range in size from micro to medium; therefore, these enterprises lack knowledge, expertise and/or financial resources to handle even the limited-complexity challenges.

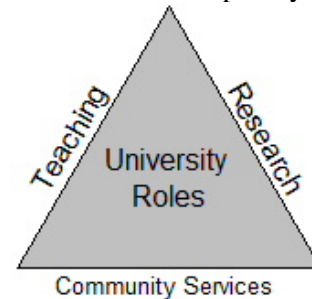


Fig. 1: The Tirade of University Roles

Striking a balance between the above three roles is a continuous challenge for universities, particularly in developing countries. The challenges can be divided into two parts. Firstly, there is a lack of applied research on institutions' research agenda that can be translated into useful products and successful spin-offs. The main reason responsible for this deficiency is universities academic promotion system on the professorship scale, which is based on publishing articles in international referred journals. An applied research addressing local concerns might be difficult material to publish. Secondly, there is lack of interest in assessing local organizations needs which will lead them to prosper through small projects or technical assistance services. This is partly due to lack of faculty hands-on experience, and hence, inability to assist in solving the industry challenges. The other reason is the limited financial resources of these industries, thus, making such assistance for faculty financially not rewarding.

4 Academic Program

This section focuses on methodologies to foster an academic program and culture that renovate students' perspective regarding risk taking. This leads to cultural change among students impacting creativity, innovation, and entrepreneurial behaviour. Wang and Wong [33] in a study on undergraduate students found that they have high level of interest in entrepreneurship but their inadequate business knowledge and perceived risk

are found to be significant deterrents to realize a business. Mok [15] discussed how academic institutions in Hong Kong promoted entrepreneurship and encouraged both faculty and students in this regard. In Souitaris et al. [28], they showed how academic programs can shape students' entrepreneurial intention. Ultimately, this result in building a critical mass of sizeable number of small businesses that would impact the developing economies.

Academic programs in general consist of mandatory university and college courses, elective university courses in addition to the mandatory and elective department courses. Parallel to the above, there are graduation projects, practical training, class projects, extracurricular activities and training. Many students' attitudes are set by certain cultural drives, and cultural changes are very difficult to achieve and takes long time to accomplish. Consequently, small doses of information and knowledge related to risk taking and entrepreneurship during students' college life would result in the needed transformation.

The following is a proposed scheme for actions toward dissemination of business-related skills. This will also help students in creating their own dreams and realizing them through spin-off businesses. Student's college life is composed of a number of building blocks described below.

Classes: Faculty have great responsibility in directing students toward making these new set of choices. They have long contact hours with students and in many cases are role models for this young generation. Therefore, this influence can be utilized in a systematic way to achieve these preset goals for the academic program. This collective effort by the faculty (through examples in classrooms, pro-longed business-related discussions, business focus groups, and professional guidance) would lead to reshaping students' goals and future.

Class Projects: The latest model of engineering teaching is to have more hands-on components within the academic program. This can be achieved by requiring class projects for the senior year's courses. This would impact the team working abilities, communication and presentation skills in addition to the technical benefits. Furthermore, for the imaginative and creative, this can be a good platform to initiate effort toward realizing their small businesses.

Graduation Projects: This is a milestone in students' academic endeavor, thus, grand effort should be exerted to execute them. Mature and serious students usually benefit the most from these graduation projects. The roadmap set by the

academic program with the predefined objectives and with the building blocks shown in this paper should accelerate the maturity of students and make them better and enthusiastic learners. This impacts both their academic retention level and their readiness to become entrepreneurs. Students can use the graduation project to conduct a feasibility study of their conceived small-business or project followed by building a prototype or model to prove the concept. Once they are convinced by the feasibility of their idea, they can write a detailed business plan and seek funding even before graduating. This would be the ideal scenario of graduating an entrepreneur from the school.

Practical Training: This is yet another milestone for the students at the university. It is their moment to put together the pieces of the learning puzzle together and to realize why they learned what. Nevertheless, for those who chose to be different, it is another opportunity to align their learning and training objectives toward reaching their entrepreneur goal. Physiologically, these students reach a point where the conscious mind get alerted whenever it detect an object or experience that have an impact on that internalized goal.

Seminars: A seminar series with focused purpose for different level students would have high impact toward certain set goals. The seminar topics can vary widely as: success stories of young entrepreneurs, business plan writing, business start-up challenges, finance, marketing, product life cycle, funding windows for such small businesses, etc.... These seminars are of extreme importance since they motivate students, challenge and change their comfort zone. Over time, this can make a difference. Additionally, these are public seminars; hence, they can help students from different departments and colleges in exploring these new choices.

Surfing the Internet/Websites: In addition to existing websites for the different courses, a specialized website for entrepreneurship and business-related issues is valuable. Such a website will be a good accessible resource for any student with thirst for knowledge in this area. Such a website would have the following content:

Focused information about starting your own business, from business plan writing, finance, marketing, and feasibility studies, etc....

Links to activities and centers promoting entrepreneurship to take advantage of their experience.

Success stories, and links for businesses that started in a similar way.

Links to local and regional funding agencies and non-governmental organizations (NGOs) that are concerned with promoting small and medium-sized enterprises (SMEs).

Time management and project management tutorials to assess students in their entrepreneur endeavor.

Links to governmental organizations of interest to business and trade, such as customs department, ministry of trade and industry, ministry of planning, ministry of labor, etc....

In summary, the purpose of this website is to facilitate for interested students the process of getting information, and therefore, eliminating the excuse of not having enough time during their busy study schedule for such an extra effort.

Department Library: In the department library, in addition to the academic books and periodicals, special section is dedicated to the entrepreneurship topic. In this section, books and periodicals related to business start-ups are made available to students to use. Example topics in this section are entrepreneurs, marketing, motivation books, entrepreneurs' success stories, taxation laws, project management, etc....

Soft Skills and Business-related Training: Parallel to the academic program, training workshops are conducted in a number of topics that would enhance the marketability of the students. Training can be in soft skills development: presentation and communication skills, report writing, conducting interviews, job hunting and resume writing. For students who speak English as a second language, English-speaking clinics are held in which students can practice speaking English with their peers while having the facilitator either a native English speaker or the one with best Spoken-English abilities. As for the training related to business start-ups, training can be held in topics such as: entrepreneurship, project management, business plan writing, feasibility studies, marketing, finance, risk management, creative thinking and problem solving, professional ethics and tax laws. It is recommended that universities offer professional help in conducting feasibility studies, business plan writing, and seeking funding through a specialized entrepreneurship office.

Extracurricular Activities: Students' growth is complemented through participation in non-academic activities at the university. It is of prime importance to give university students some space to run their own professional organization or club. Students may publish newsletters that address certain technical and non-technical issues. These activities nurture students' character to be mature, responsible, committed, and independent and foster

their leadership and interpersonal skills. Moreover, these activities have a positive impact on students' emotional intelligence. This would yield the well-rounded graduate that employers would compete to hire.

Industrial Interaction Days: Closing the loop with the industry can happen through annual interaction days with the industry. This event has multitude of advantages: feedback on graduates' strengths and weaknesses, interaction platform between industry and university, recruiting event, and display for the academic achievements of the program during that year. Students may help in organizing the event which would enhance their interpersonal and leadership skills and they may use the event as a networking opportunity, and sometimes leaving a good impression that lands them a job.

Homeworks and Studying: This can and should take a major chunk of students' time during their college life since the objective of their presence at college is to gather information and learn before leaving college and contributing positively toward the community in large.

Social Interaction and Hobbies: These activities are extremely important since they enhance social intelligence and lead to acquiring peace of mind and wellness of being. They would make huge impact on all the other components of college life in particular and quality of life in general.

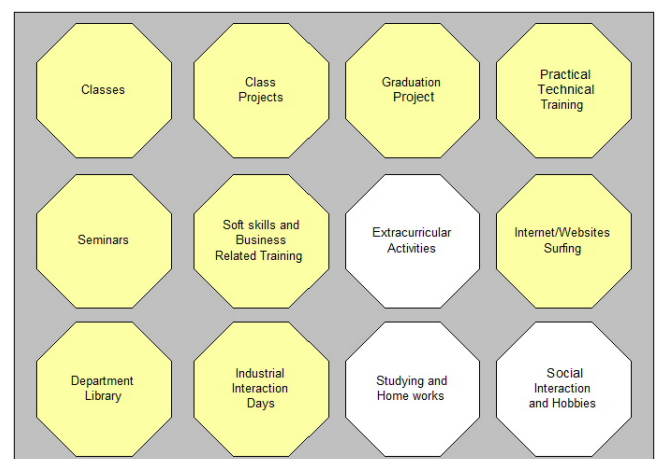


Figure 2: College Life Components (colored octagons represent activities which faculty could influence)

The above roadmap may seem exhaustive; nevertheless, with dedicated faculty, clear academic objectives and with realistic implementation plan, it can be achieved. At the Industrial Engineering Department at Jordan University of Science and

Technology in Jordan, the above roadmap was implemented and when bench marking the department students against the other departments, there is a clear difference in terms of students' soft skills, personality and emotional intelligence. Self satisfaction due to this distinguished output is the reward that faculty seek.

5 University Incubators

The previous section showed an implicit scheme to promote entrepreneurship; however, an explicit methodology is to have university incubators. Incubators nurture ideas with high potential for success, and spin them off as businesses. Moreover, they create a stage with a positive atmosphere that promotes creativity and innovation. They act as an umbrella for multidisciplinary projects creating synergy and breakthroughs. Incubators in some cases can be used to exchange ideas and assistance between academia and industry which is the model that is more appropriate for developing economies because of the limited technical and financial resources. Consequently, this particular model would be the one discussed in more details in the paper.

5.1 Incubator Overall Objectives

Since this is not a traditional incubator, rather, it is an entrepreneurial help center; it has a not traditional set of objectives. The general objectives of such an incubator are:

Benefit the local industry through technical assistance and applied projects and research in addition of being a platform to exchange ideas and build ties between academia and industry.

Provide students with soft skills and entrepreneurship training in addition to other skills that enable them to be more effective within the workforce.

Provide business counseling, feasibility studies, and business plan writing assistance to students and assist spin-off start-up companies in their sun-rise effort, hence act as a traditional incubator.

5.2 Incubator Training Objectives

Such incubators in addition to the above stated general objectives will provide students with training on some needed topics. These topics provide students with soft-skills and business-related training that are highly appreciated in the market. Additionally, this training provides new

graduates with mobility and freedom, since it opens for them new horizons of options; such as starting their own business. The students get formal training on a number of areas that are essential for their comprehensive technical and business development. Some of the topics are entrepreneurship and business plan writing, marketing, finance and feasibility studies, management, and human resources. In addition to the above topics, any other topic that is appropriate for a group of students can be offered. The above training would provide students with tools and new thinking dimension. Therefore, students start to explore completely new set of options that would help them mold their future differently. This will transform many graduates from being job seekers to job creators for themselves and for the others through starting their own businesses.

The main challenge for developing economies, however, is coming up with the fund needed to institute these incubators, more so within the public universities. Therefore, the following proposed scheme can be beneficial to overcome this financial challenge.

5.3 Financial Support Schemes

The sustainability of such projects is more important than its creation. Seed money to cover initial establishment can be collected from both private and public sectors, however, running cost should be covered from within otherwise at some point funding would dry up. Hence, the following mechanism is recommended to ensure survivability. Private sector would allocate the required seed capital. The advantages for this scheme are that the investors would supervise and ensure that the incubator will succeed by providing proper mentoring and management in addition to adopting some graduating ideas from the incubator and carry them to their full potential to become mature businesses all that while ensuring that operations within the incubator are business-oriented. Investors would ensure incubator's long-term sustainability, both institutional and commercial. Institutional: the sustainability of the academic institutions involvement is based on the amount of motivation of the academic staff which can be strengthened through monetary return and recognition system and can flourish if academic promotion system can be tied with incubator successful spin-offs. Commercial: the investors would ensure that the business is successful and hence will ensure its sustainability.

Industry-academic partnership concept: This is an innovative concept and has many advantages for both academia and industry, namely:

Training future engineers within the incubator: Provide students with training tailored around their current and future needs. These skills for future engineers would impact their creativity and innovation in any career they land. This was discussed in details by Menzel et al. [14].

Strengthening the relationship between academia and industry.

The incubator is an enabling platform to let the academic staff obtain the needed practical experience that is really needed by the local industry and this experience would be transformed to students in the classrooms.

The incubator may spin-off a number of entrepreneurs and businesses resulting in improving the economy. The trend of starting small businesses would create the economical critical mass that is able to change the face of the developing economies.

The students are a low-cost labor resource that can be developed and utilized. Hence, working on projects for the local industry becomes affordable. This will create steady demand on the incubator services, which improves the survivability and sustainability potential of the incubator.

Promotion of Interdisciplinary Research and Development: Universities usually are composed of a number of colleges and departments (Engineering College (architectural, chemical, electrical, industrial, mechanical ...), Science (computer, math, chemistry, physics, and biology), Medicine, Dentistry, Pharmacy, and Agriculture colleges). This wide spectrum of disciplines makes large-scale interdisciplinary research and development activities viable. Such an incubator will promote communication across different fields, enhancing system engineering and collaboration; hence, setting the foundation for developing sophisticated systems. Additionally, the infrastructure of the incubator will be an enabling platform to develop some special research programs in key technical areas and a platform for technical assistance for the local and regional industries.

5.4 Incubator Feasibility from Commercial Point of View

The incubator viability for commercial partners stems from two issues. The first issue is that the incubator provides to them a low-risk development center for untested concepts, or even develops some viable ideas that have some commercial value. In either case, enterprises get a low-cost developed

concepts that are otherwise either costly to develop in-house, or companies lack the expertise to develop these concepts internally, or they are busy with the operations making R&D marginalized. The second issue is that this incubator acts as a development center for local industries, thus, the incubator provides training and testing vehicle for potential employment by participating enterprises. Company project executers are being examined continuously and while students are working on projects for a certain company, they would interact frequently with the clients getting the enterprise/client to know these students more. Additionally, since students are working on a focused project for a certain enterprise, they will get indirect training to join that enterprise. This would minimize the risk for the enterprise and would get students half way ready to join these companies once they graduate.

The above guidelines for university incubators in emerging economies is thought to be more suitable for such economies because of the financial restrictions, hence, when starting such incubators in these emerging economies, risk has to be minimized and sustainability should be secured. Furthermore, these incubators should have multi-faceted objectives as explained earlier.

6 Implementation Challenges

There are some challenges that face the implementation of what was discussed in this paper. Some of these challenges are discussed next. Since it's a new model that lies outside the comfort zone of the faculty; then, its implementation would require a lot of convincing and incentives. This is particularly true knowing that most faculty members lack the traits of entrepreneurs. Hence, a massive awareness and training program for the faculty should be implemented first to achieve these set specific goals of the academic program.

Another challenge is that faculty are entrenched in their ivory towers, and view technical assistance and community service a waste of their precious time. Therefore, to change this status-quo, the promotion system within universities has to change to reflect these new priorities and promote these important directions. A related issue is the credibility of faculty's ability to solve industrial challenges. Because of the lack of strong relationship between industry and universities, there is skepticism regarding universities' abilities to resolve industry challenges. This can be resolved only with time and through good number of success stories. Additionally, if students did not see for prolonged periods of time any successful outcome from the

academic program or university in terms of successful spin-offs, this would question the purpose of this effort and its viability.

The above were only a partial list of potential challenges that have to be overcome. This is again due to the cultural issues ingrained in academia in particular and in conservative cultures in general. Overcoming matters related to culture are very difficult to overcome and may take long durations to achieve. Hence, patience, endurance, commitment and determination should be the attributes for those leading this effort.

7 Conclusions

This paper introduced a model for academic institutions to assess their effort in creating a paradigm shift in students' traditional line of thinking of shying from business and risk taking to one of challenge facing and entrepreneurship. In this model and to achieve this shift, effort is exerted in each block of the academic program from classes, graduation and class projects, seminars, workshops, extracurricular activities and closing with the practical training. In all these elements, an orchestrated effort should be exercised in order to amplify results and avoid inconsistencies.

Moreover, this paper discussed a particular form of incubators suitable for emerging economies that is financial resources bound. These incubators serve a multitude of functions in addition to the traditional role of incubating potential-businesses. Other roles are: serving as a training site for business-related and soft skills topics, and serving as an expert house for the industry to promote the universities' role in serving their communities. The creation of incubators in emerging economies is still a financial challenge, therefore, in the proposed model private investors fund the incubator start-up and through specific industry-university partnership agreements, industry rights in incubators' outcome are preserved. Additionally, this functional scheme for incubators would encourage the interdisciplinary research and development, which only then true rewards and breakthroughs are achieved.

The paper discussed some implementation challenges that face putting forward such a program. Only serious effort and commitment at the department level and support from the university executives can ensure true and successful achievement of the entrepreneurship-related set goals.

In conclusion, promotion of entrepreneurship at universities should not be optional and is not a luxury; it is a matter of national importance that has

huge economical rewards for the individuals involved and for the country in-large. Therefore, universities should start systematic effort in entrepreneurship promotion regardless of effort size. This will make a difference in students' ambitions and the society collective future. Financial impact on the economy should drive policy-makers to legislate this change so as to encourage academic institutions, and public ones in particular, to fulfill their duties toward the taxpayers.

References:

- [1] Alistair, B., Gibson, D., Smilor, R., University Spin-off Companies: Economic Development, *Faculty Entrepreneurs, and Technology Transfer* (Rowman & Littlefield), 1991.
- [2] Baumol, W. J., Formal Entrepreneurship Theory in Economics: Existence and Bounds, *Journal of Business Venturing*, Vol. 3, 1993, pp. 197-210.
- [3] Carrayannis, E., Rogers, E., Kurihara, K., Allbritton, M., High Technology Spin-offs from Government R&D Laboratories and Research Universities, *Technovation*, Vol. 18, No.1, 1998, pp. 1-11.
- [4] Clark, W., and Lund, H., Sustainable development in practice, *Journal of Cleaner Production* Vol. 15, 2007, pp. 253-258.
- [5] Dasgupta, P., David, P.A., Toward a New Economics of Science, *Research Policy*, Vol. 23, 1994, pp. 487-521.
- [6] Etzkowitz, H., Webster, A., Healey, P. (Eds.), *Capitalizing Knowledge: New Intersections of Industry and Academia*, State University of New-York Press, Albany, NY, 1998.
- [7] Hamel, G. and Prahalad, C.K., *Competing for the Future*, Boston, MA: Harvard Business School, 1994.
- [8] Ireland, R., and Webb, J., Strategic entrepreneurship: Creating competitive advantage through streams of innovation, *Business Horizons* Vol. 50, 2007, pp. 49-59.
- [9] Jacob, M., Lundqvist, M., Hellsmark, H., Entrepreneurial transformations in the Swedish University system: the case of Chalmers University of Technology. *Research Policy*, 2003.
- [10] Klofsten, M., Training entrepreneurship at universities: a Swedish case. *Journal of European Industrial Training* Vol. 24, No.6, 2000, pp. 337-344.
- [11] Mansfield, E., Academic Research Underlying Industrial Innovation: Sources, Characteristics,

- and Financing, *The Review of Economics and Statistics*, Vol. 77, No. 1, 1995, pp. 55–65.
- [12] Mansfield, E., Academic Research and Industrial Innovation: An Update of Empirical Findings, *Research Policy*, Vol. 26, No. 7/8, 1998, pp. 773–776.
- [13] McMillan, G.S., Narin, F., Deds, D.L., An Analysis of the Critical Role of Public Science in Innovation: the Case of Biotechnology, *Research Policy*, Vol. 29, No. 1, 2000, pp. 1–8.
- [14] Menzel, H., Aaltio, I., and Ulijn, J., On the way to creativity: Engineers as intrapreneurs in organizations *Technovation* Vol. 27, 2007, pp. 732–743.
- [15] Mok, K., Fostering entrepreneurship: Changing role of government and higher education governance in Hong Kong, *Research Policy* Vol. 34, 2005, pp. 537–554.
- [16] Ndonzuau, F., Pirnay, F., and Surlemont, B., A Stage Model of Academic Spin-off Creation, *Technovation*, Vol. 22, 2002, pp. 281–289.
- [17] OECD, *Fostering Entrepreneurship*, OECD, Paris, 1998.
- [18] Phillips, D., New Alliances for Policy and the Conduct of Research and Education, *International Journal of Technology Management*, Vol. 6, 1991, pp. 478–487.
- [19] Powers, J., and McDougall, P., University start-up formation and technology licensing with firms that go public: a resource-based view of academic entrepreneurship, *Journal of Business Venturing* Vol. 20, 2005, pp. 291–311.
- [20] Radosevich, R., A Model for Entrepreneurial Spin-offs from Public Technology Sources, *International Journal of Technology Management*, Vol. 10, No.7/8, 1995, pp. 879–893.
- [21] Rasmussen E., and Sørheim, R., Action-based entrepreneurship education, *Technovation* Vol. 26, 2006, pp. 185–194.
- [22] Reitan, B., Fostering Technical Entrepreneurship in Research Communities: Granting Scholarships to Would-be Entrepreneurs, *Technovation*, Vol. 17, No. 6, 1997, pp. 287–296.
- [23] Roberts, E.B., *Entrepreneurs in High Technology: Lessons from MIT and Beyond*, Oxford University Press, Oxford, 1991.
- [24] Roberts, E.B., Malone, D., Policies and Structures for Spinning-off New Companies from Research and Development Organizations, *R&D Management*, Vol. 26, No. 1, 1996, pp. 17–48.
- [25] Santoro, M., Success Breeds Success: The Linkage between Relationship Intensity and Tangible Outcomes in Industry-university Collaborative Ventures, *The Journal of High Technology Management Research*, Vol. 11, No. 2, 2000, pp. 255–273.
- [26] Sciolla, E., *The status of Product Design in Jordan*, EJADA, Minutes of workshop, Amman, Jordan, March, 2004.
- [27] Shane, S., Encouraging university entrepreneurship? The effect of the Bayh-Dole Act on university patenting in the United States, *Journal of Business Venturing* Vol. 19, 2004, pp. 127–151.
- [28] Souitaris, V., Zerbinati S., Al-Laham A., Do entrepreneurship programmes raise entrepreneurial intention of science and engineering students? The effect of learning, inspiration and resources, *Journal of Business Venturing*, Vol. 22, 2007, pp. 566–591.
- [29] Stankiewicz, R., Spin-off Companies from Universities, *Science and Public Policy*, Vol. 21, No. 2, 1994, pp. 99–107.
- [30] Steffensen, M., Rogers, E., Speakman, K., Spin-offs from Research Centers at a Research University, *Journal of Business Venturing*, Vol. 15, No. 1, 2000, pp. 93–111.
- [31] Tidd, J., Bessant, J., and Pavitt, K., *Managing Innovations: Integrating Technological, Market and Organizational Change*, 3rd ed., John Wiley & Sons Ltd, London, 2005.
- [32] Venkataraman, S., Regional transformation through technological Entrepreneurship, *Journal of Business Venturing*, Vol. 19, 2004, pp. 153–167.
- [33] Wang, C., and Wong, P., Entrepreneurial interest of university students in Singapore, *Technovation* Vol. 24, 2004, pp. 163–172.