

CURRICULUM MODEL DESIGN TO PROMOTE THE ESTABLISHMENT OF TECHNOLOGY-BASED ENTREPRENEURS

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ABSTRACT. Based on the experiences of universities worldwide that are positioned in the development of entrepreneurship and the results of models applied in Colombia, this article proposes topics for training, motivating and supporting the creation of spin-offs from university activities and describes its integration with a suitable environment to support that process.

KEY WORDS: Entrepreneurship, Innovation and technology, Technology-based Entrepreneurs, Start-Up.

INTRODUCTION. In recent years there has been a growing trend towards the creation and development of enterprises producers of goods and services with high added value of knowledge, characterized for being based on research and development processes, for being innovative in various stages of the chain value, for being highly differentiated, for taking new markets in new ways, for having high profit margins on products and / or services offered. These companies are known as technology-based, they are developed mainly in areas such as: computing, communications, new materials, biotechnology, electronics, and instrumentation. They have their origins, in most cases, spin-offs of projects conducted by universities and centers of specialized human talent, which have invested in infrastructure and research. Due to the impact of these companies in regional development, it is important to investigate on the requirements of training, motivation and support that are necessary to create technology-based entrepreneurs from universities activities. Therefore, the research question is: What is the curriculum model and the recommended environment to adequately promote the creation of technology-based entrepreneurs? To resolve this question of research an investigation had been developed from the experiences and models that have been effective in the creation of technology-based entrepreneurs in many institutions.

1. RESEARCH PROBLEM.

Educational institutions are the main actors in the promotion of entrepreneurship (Varela, 2008), because they have generally acted by establishing entrepreneurship programs to develop an entrepreneurial culture. These programs, which are increasingly taking force in the country's universities, usually are not designed or focused to encourage entrepreneurs to create technology-based companies. The proposed curriculum models are strongly focused to learn and develop the competences of the entrepreneur and, on the other hand, to clearly structured a business plan, as a result of an organized methodical process that applies to a generic type of business.

Technology-based entrepreneurs are characterized by: A) Use of innovative technology in all stages or components of the process of generating business value (resources, design, process, equipment, production, marketing, distribution, payment, etc). B) Provide innovative solutions to the needs and demands of the client. C) Have higher rates of growth and profitability in relation to its sizes and operating time. D) Have the technological knowledge and the innovative capacity as its main assets. Morales (2007) exposed that "the importance of technology-based companies is that they support their management strategies and their line of processes, products and services in new technology and involve administrative developments, managerial, economic, financial, training, and research and development, of first generation in its operations". Lopez and Tognato (2006) exposed that technology-based companies are enterprises whose competitive factor is the knowledge.

All companies go through different development stages, but it is very important to take in mind the growth stages of a technology-based enterprise, and define the limits of the actions of the universities with them; which are the areas where companies need help to get position in the targeted market, and stay on it. Thus authors such as Camacho (2002), Varela (2008) y Sabala (2006), have defined the stages through which the technology-based companies pass, and in general all companies.

- *Conception and Development:* The first step that the enterprises have to make is the business plan where they develops the concept of the company, identifying different factors that affects positive and negative to the company; thus the entrepreneur verifies the viability of the company and the financial possibilities to run the enterprise.

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- "Start-up" or Beginning: The second step to follow is to put the company in operation, with few employees and where the owner has much of the responsibility for the operations of the company. The main idea in this stage is to survive and to begin to enter into the targeted market which was planned since the beginning of the business plan.
- Survival: At this stage, the enterprise has small number of customers which are satisfied with the products or services. At this stage there is no certain about the future of the company, because it is possible that the sales growth forecast has not been accomplish and the organization dies (Miranda, 2007).
- Growth and Expansion: The enterprise has acquired greater percentage of the target market, thus its products or services are demanded in larger quantities, which require the involvement of new employees to contribute in the production process. Also it is necessarily to add trained people to be responsible for managing the company.
- Consolidation: At this stage the companies are responsible for strengthening their competitive advantage in order to remain at this level in the market, or exceed its competitors.
- Maturity: The company has a fixed size of the market where their products will be commercialized without saturating consumers with advertising, because the product or service is recognized in the market

Traditionally, universities actions reach the stage of design and development, and in some cases, through the following areas of business support, the stage of start-up and survival of the company:

- Scientific Parks: Industrial area properly conditioned and reserved for the activity of research, development and prototype projection of public and private enterprises, establishing contacts with institutes of higher education and advanced technological training.
- Technological Parks: A large area strategically located and developed to provide an environment that manages to attract new small businesses or large sections, both of high technology. Universities, public research organizations, services of various kinds, etc, are part of the environment in which companies can not only investigate but also produce, and in some cases, commercialize the results of their research. Includes R+D, production, sales and services.
- Business Incubator: Business incubators are institutions that drive the process of creation, growth and consolidation of innovative and technology-based, from the ideas and capabilities of entrepreneurs. They are usually non-profit organizations, formed through partnerships between public, private and educational with the participation of training institutions, public and private companies, local governments, trade associations and chambers of commerce.

Lopez and Tognato (2006) suggest four stages for these processes Incubation:

- Sensitization: The idea in the sensitization process is to focus on certain groups of professionals or businessmen so that they participate in activities offered by these spaces; at this stage are identified entrepreneurship and entrepreneurs are encouraged to enter in the business incubators or parks.
- Pre Incubation: The main objective of this stage is to review and attend the initiatives that were chosen in the sensitization process; to consolidate the business opportunity, for what have to be chosen: teamwork, a business model that is intended to implement, the management of the capital necessary and the implementation of the business plan.
- Incubation: The incubator offers a portfolio of support services of the business opportunity looking to: develop, strengthen and define a strategy to enter into the market, the retention and the sustainability of the company in the market.
- Post incubation: The incubator maintains relationships, not so formal, and maintains contact with companies that have graduated from the incubation process, providing support and monitoring to them.

Surprisingly, the connection between the operation of these entities and the curriculum models of the universities is almost none. Most companies that are results of these accompanied processes are not based on university training process that will give companies the technology-based features. There is no curriculum model known for this purpose, and therefore the results of the efforts in Colombia with this type of spaces have been expected.

2. METODOLOGY

To develop this research, the curriculum models used by the most important centers of development of entrepreneurship in the world and the environment models to help in the creation of this type of business applied in Colombia, where identified. To select the models with most impact worldwide, the following publications where used:

- a) *2008 University Entrepreneurship Productivity World Ranking*, that was developed by the investigators from the *Neely School of Business* of the Texas Christian University, with the cooperation of the universities of Florida and Texas A&M
- b) *2009 World's Best Colleges: Top 400*, provided by the *U.S News & World Reports* (see Table 1)
- c) *Colleges Specialty Rankings: Undergraduate business specialties: Entrepreneurship* de *U.S. News & World Report*, , in partnership with *Fortune Small Business: America's Best Colleges for Entrepreneurs* (see Table 1)

Table 1 shows the final selection made, taking as criterion the inclusion of curriculum models oriented in generating spin-offs, and that did not have support to Start-up of technology-based business in this model.

Table 1. Colleges Rankings

Rank	Top 400 Best International	US Best Colleges	Universidad
*	17	4	Stanford University
1	170	71	<u>Indiana University</u>
2		110	Texas Christian University
4	501+	61	Clemson University
4	170	-	University of Calgary
7	7		City University of London
7	121	53	Ohio State University
7	174	42	Rensselaer Polytechnic Institute
7	400-500	58	<u>Syracuse University</u>
7	394	-	University of London
7	389	102	University of Missouri-Columbia
7	382	102	University of Oklahoma
7	96	24	University of Virginia
20	-	-	Babson College
20			National Taipei University
20		88	North Carolina State
20		80	Northeastern University

(Source: Author)

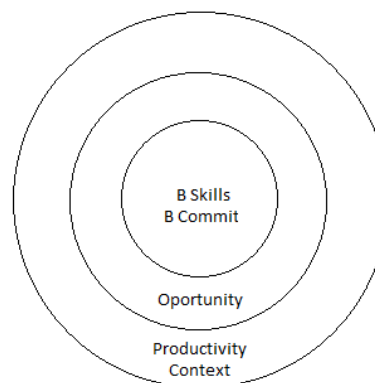
Complementing the research, an exploration was made about Colombian cases of environments implemented in Colombia until 2007 and the experience developed during 4 semesters by the Development Center of Entrepreneurship at the Universidad Icesi, with the proposed curriculum model for some of its careers.

3. PROPOSED MODEL

For the proposed model is essential to define new guidelines that allow involving incentives for innovation and scientific research leading to technology-based companies in the training process.

Figure 1. Components of the Curriculum Model

- Entrepreneurship Skills (ESkills) (Varela, 2008)
- Entrepreneurship Commitment (ECommit)
- Entrepreneurship Assets (EA) = ESkills x ECommit
- Economic Value (EV) = Oportunity x EA
- **Generation of Value = Productivity x Context x EV**



Source: Dorf, 2008

For the curriculum model, the emphasis is clearly shown in the curriculum model of the universities selected to teach primarily to identify business opportunities that have not been exploited, to develop the skills of entrepreneurship and to

strengthen the commitment that drives to take action in a company. Up to this point and according to the reference model, the effort has been focused on creating economic value (EV).

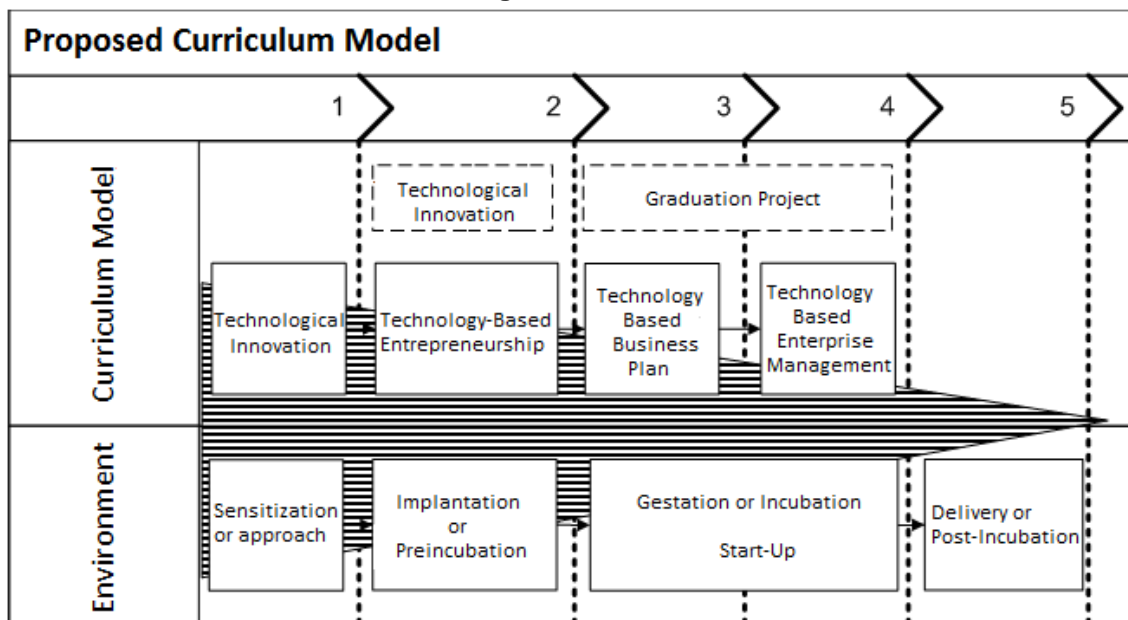
Finally, to reach to the generation of business value, these universities, especially those that propose curriculum models that reach graduate programs, complete the cycle by strengthening the knowledge of the context and the skills to achieve better indicators of productivity in already established companies.

The starting phase for the proposed model must constantly seek knowledge and research of the technological base of the operating area of the beneficiary, and this should be integrated into the stages proposed by Dorf (2008) and Varela (2008). Five stages are set and show below (see Figure 2):

- a. Phase 1: "Technological innovation". This phase will introduce and investigate the knowledge of new technologies and its trends, and motivates the generation of applications of these technologies or knowledge of the environment
- b. Phase 2: "Technology-based entrepreneurship". This phase will cross the skills of development and entrepreneurial business career plan, developing business opportunities that align with the strengths of the entrepreneur. A directly relation with technology-based entrepreneurs at this stage enhances the development of the entrepreneurial vision of the beneficiary.
- c. Phase 3: "Technology-based business plan". This phase will develop the business plan and prototype that gives rise to the business. The relationship with business models developed becomes a strong support for these companies.
- d. Phase 4: "Management of technology-based business". This phase will develop management skills oriented to productive enterprise and high value creation. Practical experience in this phase must be accompanied by processes of training that will help entrepreneurs to strengthen their business model.
- e. Phase 5: "Accompaniment". At this stage the company receives very specific support from the current curriculum. The formed company should have the basics to face the strengthening and growth stage.

On the other hand, from the supportive environment, it is necessary to pay main attention to the needs of businesses. This environment must support the processes of business awareness, identifying opportunities, formulating business plans and development of prototypes. The most important thing in this case is to provide activities of managing and motivation, without leaving the facilities and physical characteristics that companies should have to be associated with that space. This environment should provide to the beneficiary, clear and explicit tools to achieve and develop skills to identify and build competitive business models, including as a center innovation and technology, allowing them to highlight and explain the differentiating elements of this type of business in the different sectors of the economy.

Figure 2. Model



Source: Author

Figure 2 illustrates the model which integrates curriculum and environmental strategies to promote the creation and strengthening of technology-based companies.

The elements of this model are:

- For the curriculum model to prioritize components listed in the following order:

- a) Business opportunity, where they form the basis of knowledge and skills in the use and application of technological innovations.
 - b) Skills and corporate commitment, which manages the development of entrepreneurial skills and creative processes that help to identify opportunities for technology-based company.
 - c) Business context, which makes a complete business plan and a prototype of the proposed solution.
 - d) Business Management, which aims to develop skills for managing technology-based companies.
- For cases in which the academic foundation is not strong enough in technology is necessary for the curriculum model to raise a reinforcement of this component in the second phase.
 - For the environment, sensitization or approach, and gestation or incubation are the stages in which the entrepreneur demands greater attention, since on the one hand it makes the whole process of motivation toward a business career, and secondly, will support the decisions that are the basis for the operating business. Although the development of business plan in some models used is not taken into account is indispensable especially in these types of businesses. In these stages is where the university actions have greater impact.
 - The development of a graduation project or a parallel research substantially based the creation or strengthening of a technology based company. This development comes with the Start-Up of the company and the first part of the incubation stage in which the company validates its invention to the market.
 - Should be encouraged in decreasing the divergent development of new business ideas or new ways of dealing with the different processes of entrepreneurial careers. In the example given in Figure 2, this process is represented by a triangle that touches on some of the existing processes in the proposal. This divergence leads to convergent processes that affirm the business process
 - Being the objective of the model to support the creation of technology-based companies, the integration of space with the model curriculum should be given mainly in the Start-Up stage of the business process, in which, proximity to the tools, resources support and especially to the business community, facilitates the process of entrepreneurship.

On the other hand, on the basis of curriculum experiences and training elements proposed by Varela (2008) and Dorf (2008), Table 2 exposes the objectives that the model has to seek in its operation.

Whoever executes the curriculum model in each of its phases should be fully aligned with the objectives of validation of each one. As proposed for the model:

- (1) The initial phase should be very specific to the student's career, to strengthen the concepts and skills that support the development of concepts and technology skills that provide the necessary support for the following steps.
- (2) The development of technology-based entrepreneurship and some components of the business plan should be in charge of the centers that have this purpose in each institution, implementing proven methodologies in carrying out this purpose.
- (3) Prototype development and analysis of the business plan related to technology of the own career should ideally be accompanied by experts or knowledgeable about specific issues from each career and
- (4) The elements of business management must be accompanied by the support of the community in the supportive environment and on the other hand, teachers with business experience in such companies.

Table 2. Objectives to validate

Environment	Phase of Enterprise	Curriculum Model	Objectives
Sensitization or Approach	Design and development	Technology Innovation	<ul style="list-style-type: none"> • Explain the concept innovation, science and technology as development mechanism. • Identify and explain trends in technology. • Identify future market opportunities. • Exposing the application of technology in new or existing.
Implantation or Pre-incubation		Technology-based Entrepreneurship	<ul style="list-style-type: none"> • Conceptual definition of technology-based entrepreneur. • Stimulate creativity to solve problems. • Develop a Business Career Plan. • Develop and evaluate business opportunities. • Finding appropriate technologies to meet market requirements and develop a business plan. • Accurately determine the direction that the business plan will have
	Start-Up	Technology-based Business Plan	<ul style="list-style-type: none"> • Create and sustain a business plan. • To determine the amount and sources of money needed. • Identify ways to select partners. • Learn to gather and organize information. • To determine the integral feasibility of the business. • Develop and sustain a prototype

Gestation or Incubation	Survival and growth	Technology-based Enterprise Management	<ul style="list-style-type: none"> Describe the behavior of TBE. Make real the plans made in the business plan. Have the resources needed to start the business. Emphasize how management decisions can contribute to the generation of value. Identify forms of business expansion
Delivery or Post-incubation	Survival and growth		<ul style="list-style-type: none"> Implement ways to expand the business. Practice and apply a proven planning process that increases the probability of success. Use resources to best use. Create a network with other technology entrepreneurs

Source: Author

The validation of the proposed model should have as a baseline compliance with the objectives set out in Table 2, and of course, the number of companies in the medium and long term made it to the survival and growth stage.

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